

# Overview

## Scope of this Document

This Service Guide provides troubleshooting steps, take-apart procedures, and other information about iPhone X. Other iPhone models are covered in separate guides.

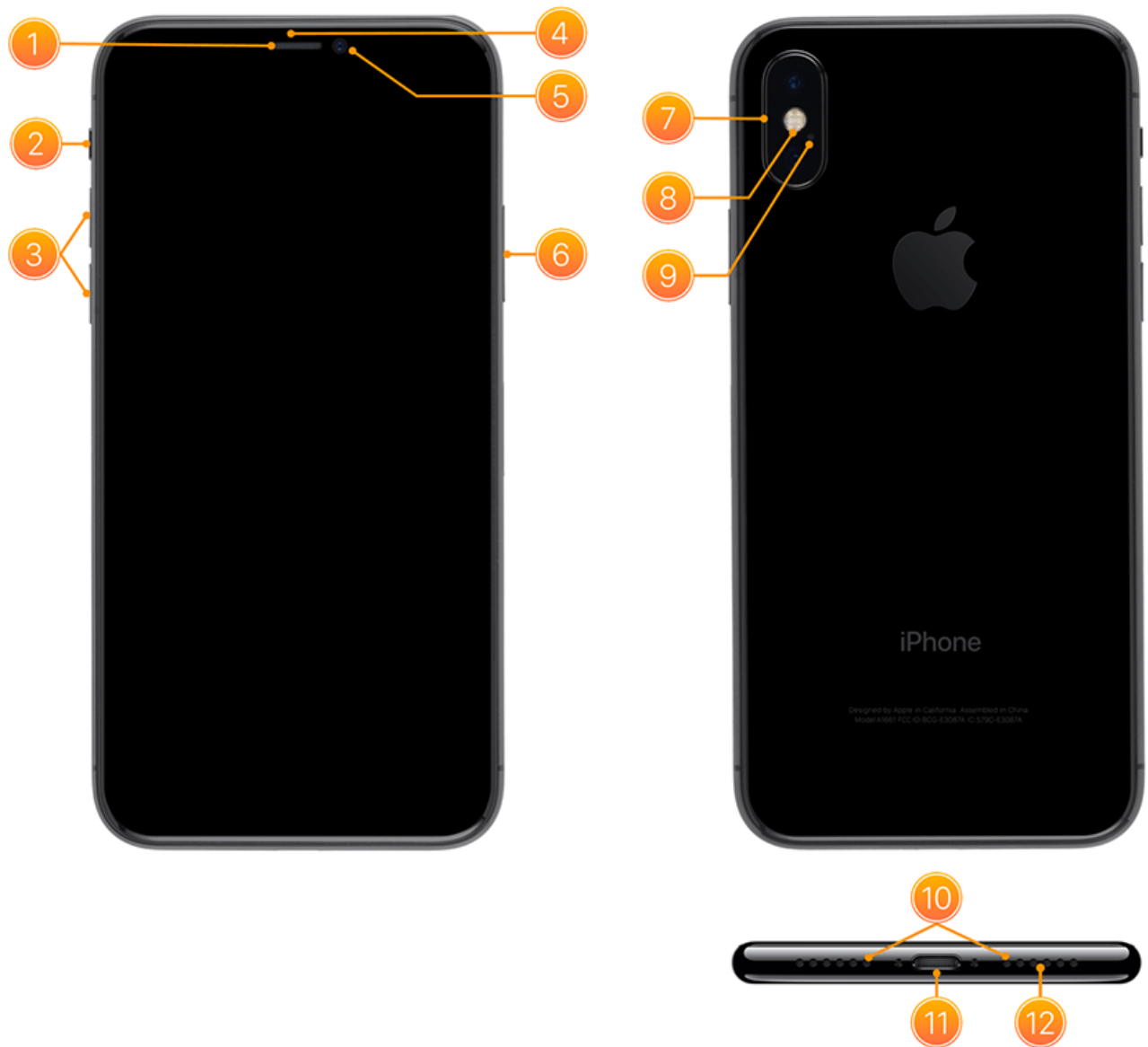
## Features



Available in space gray and silver.

iPhone X features:

- A11 Bionic chip with Neural engine
- Super Retina HD display
- New 12-megapixel wide-angle and telephoto cameras
- 7-megapixel TrueDepth Camera
- Face ID
- Water and dust resistant



1. Receiver (stereo speaker)
2. Ring/silent
3. Volume up/down
4. Proximity sensor
5. TrueDepth cameras
6. Side button
7. Cameras
8. True Tone flash
9. Microphone
10. Bottom microphones
11. Lightning connector
12. Stereo speaker

## Service Considerations

**Important:** Before servicing a device, ensure that the customer has disabled Find My iPhone in Settings. For more information, refer to article [HT201365: Find My iPhone Activation Lock](#).

If performing a whole unit replacement and the iPhone is a trusted device for two-factor authentication, then do not erase the device until the user has set up the replacement iPhone. For more information, refer to article [HT204915: Two-factor authentication for Apple ID](#).

There are several ways to find the iPhone serial number and IMEI/MEID. Refer to article [HT204073: Find the serial number or IMEI on your iPhone, iPad, or iPod touch](#).

Refer to the [Visual/Mechanical Inspection \(VMI\) Guide](#) for the specific model numbers and configuration codes.

- **Reset:** Press and quickly release the Volume Up button. Then press and quickly release the Volume Down button. Then press the Side button for about six seconds, until the screen goes black. Finally, press and hold the Side button until you see the Apple logo.
  - **Recovery Mode:** With the device plugged into a computer with iTunes open, press and quickly release the Volume Up button. Then press and quickly release the Volume Down button. Then press the Side button for about six seconds, until the screen goes black. Finally, press and hold the Side button until you see the recovery mode screen.
  - **Stereo Speakers:** The receiver and bottom speaker are used together as stereo speakers. The left and right sound channels are routed to the speaker or receiver based on the orientation of the iPhone.
  - **Cameras:** The cameras used in iPhone X periodically self-calibrate to capture sharp images. When the iPhone is placed on a flat, level surface for 5–10 seconds, the camera will perform a quick calibration. When the iPhone is plugged in and placed on a flat, level surface for 5–10 minutes, the camera will perform an extended calibration. During the extended calibration, the iPhone may become warm to the touch.
  - **Apple Pay in Japan:** iPhone X sold in Japan have specific hardware that allows customers to make Apple Pay purchases at stores in Japan. These devices can not be used to make Apple Pay purchases at stores outside of Japan. Apple Watch models sold outside of Japan will not be able to complete Apple Pay transactions at stores within Japan. Refer to articles [HT207152: Using Apple Pay in stores, apps, and on the web in Japan](#) and [HT207154: Using Suica on iPhone or Apple Watch in Japan](#).
- Important:** For Japanese devices, be sure to have the user remove any Suica card from Apple Pay before proceeding with service.

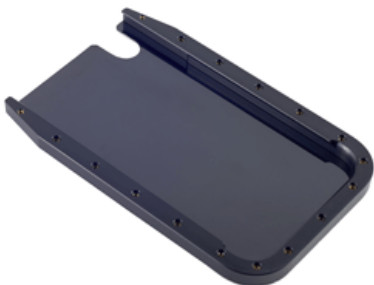
## New Tools and Fixtures

To open iPhone X, be sure to use an updated Universal Display Removal Fixture and the Display Removal Fixture Adapter with the suction cups set to the correct position. The suction cups should be set in the position closest to the bottom of the display without overlapping the edge.

Use the new Display Press to apply the correct pressure for 30 seconds to properly adhere the display to the enclosure. Refer to article [RP1397: Open Device](#) for more information.

For more information about updating your existing fixtures, refer to article [TP1531: iPhone Fixture Update - Universal Display Removal Fixture and Display Press](#).

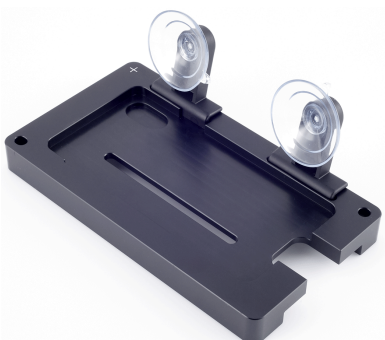
If the back cover is damaged, apply a 5.8-inch Back Protective Cover (923-02233), then place the iPhone in the 5.8-inch Support Frame (923-01922) before attempting to open the device.



### Caution:

- An incorrect position or the use of other fixtures may cause damage to the device.
- Fixtures that clamp the iPhone may damage the enclosure. iPhone X displays are adhered to the enclosure.

Once the device has been opened, use the 5.8-inch Repair Tray (923-01920) to support it. The 5.8-inch Repair Tray is identified by a plus sign on the fixture. Each iPhone X will only fit correctly in the appropriate repair tray.



The display cowlings in iPhone X are installed using trilobe screws that require a MicroStix bit (923-01290) to remove.



Screws replaced during a repair must be tightened to a specific torque value. There are four iPhone torque drivers to set screws to the correct torque value. Use only the driver that is specifically called for in the take-apart instructions. The correct driver is also noted in the screw diagram section of the article [TP1606: Internal View, Parts List, Screw Diagram](#).

1. iPhone torque driver (gray), 0.55 kg-fcm (923-00738)
2. iPhone torque driver (black), 0.35 kg-fcm (923-0248)
3. iPhone torque driver (green), 0.45 kg-fcm (923-00105)
4. iPhone torque driver (blue), 0.65 kg-fcm (923-0448)





# iOS

## Overview

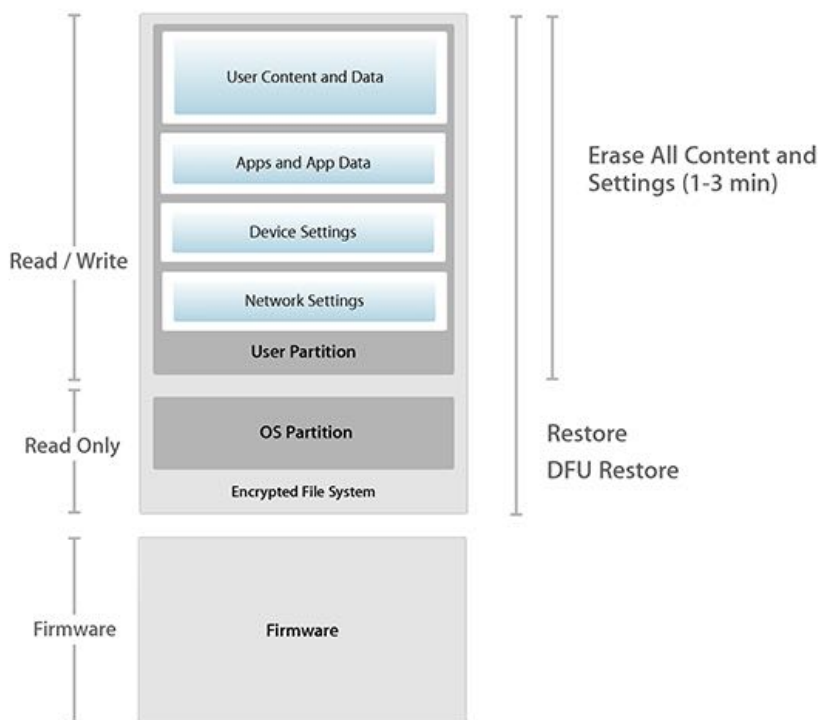
iOS 11 is the latest mobile operating system for iPhone, iPad, and iPod touch. iOS 11 is compatible with iPhone 6s or later, iPad Pro, iPad (5th generation), iPad Air 2, and iPad mini 4.

## Service Considerations

### Restore Types and File System

If the device is connected to iTunes, then updating the software may resolve an issue without erasing content and settings. If updating the software does not work, then it may be necessary to restore the device, which will erase all content and settings. Most issues reside in the read/write portion of the file system; the read-only portion cannot be modified by the user.

DF Reset and DFU Restore are not necessary to troubleshoot iOS devices. Restore and Recovery Mode Restore take less time to accomplish the same result. If the device will not go into Recovery Mode or will not charge, then follow the troubleshooting steps in the Service Guide.



## Troubleshooting

Refer to article [TP880: Common Troubleshooting Procedures](#) for more details.

To isolate a software issue, use the following steps.

1. Have the user create a backup (using either iCloud or iTunes) so that the data on the device is saved. Refer to article [TP322: Back Up User Data](#) for more details.
2. Update to the latest software.
3. Restart the device.
4. Erase all contents and settings (Settings > General > Reset > Erase All Content and Settings).
5. Set up the device as new, without restoring from backup.
6. Test the device hardware and iOS for the original issue. If the issue cannot be reproduced, do not replace the device.
7. Restore from backup. If restoring from either backup (iCloud or iTunes) causes the software issue to return, then there is no reason to restore from the other backup method as it will lead to the same result.

## iOS Diagnostics

Search for article “AST 2 for iOS Reference Guide - Table of Contents” for more information.

Apple Service Toolkit 2 (AST 2) is a cloud-based diagnostic system to help technicians triage and verify repairs for most Apple devices.

AST 2 for iOS currently supports Apple devices running iOS 8.1 or later and Apple Watch.

Some diagnostic tests and tools in AST 2 require the device under test to be running iOS 9 or later.

## Apple Apps

Apple apps may be hidden from the home screen. These apps are not deleted as they are part of iOS. These apps can be restored by searching the App Store and touching the Download button.

## Music > Optimize Storage

This feature will automatically remove songs that have not been played in a while.

## Battery

Refer to article [HT201264: About the battery usage on your iPhone, iPad, and iPod touch](#) and [HT205234: Use Low Power Mode to extend battery life on your iPhone](#) for detailed information.

### Low Power Mode

This feature allows users to increase battery life by reducing some functionality. Email fetch, Hey Siri, Background App Refresh, Automatic Downloads, and some visual effects are reduced or turned off.

Low Power Mode can be turned on manually in Settings > Battery.

When Low Power Mode is active, the battery icon will appear yellow and the battery percentage will be displayed.

### Battery Usage

Settings > Battery > Battery Usage displays battery usage by app.

This feature can display the percentage of battery use by day or week.

The Home screen and Lock screen will usually have the highest usage.

Apps that have been given permission to run in the background will be noted as “background activity.”

## Wi-Fi Assist

Refer to article [HT205296: About Wi-Fi Assist](#) for more information.

Wi-Fi assist allows a device running iOS 9 or later to stay connected to the Internet even with a poor Wi-Fi connection. If the Wi-Fi signal strength drops too low, then the device will seamlessly switch to cellular data.

Wi-Fi Assist is turned on by default.

Any iOS device that has a cellular data plan and is running iOS 9 or later can use Wi-Fi assist, except for iPhone 4s, iPad 2, iPad (3rd generation), and iPad mini (1st generation).

## iTunes



iTunes may be used to restore or update a device to iOS 11. General system requirements are listed on the download page. Download iTunes from [www.apple.com/itunes/download/](http://www.apple.com/itunes/download/).

An Apple ID is required for some iOS features. Refer to article [TP318: Apple ID](#) for specific features and Apple ID troubleshooting.

# Back Up User Data

## Back Up User Data

Before troubleshooting a user's device, verify that the data is backed up to iCloud or to iTunes on the user's computer.

**Note:** If restoring user data from either backup method (iCloud or iTunes) causes an issue to return, there is no reason to restore from the other backup method as it will lead to the same result.

### iCloud

1. On the Home screen, tap Settings.
2. Tap iCloud.
3. Tap Storage.
4. Tap Manage Storage.
5. Verify the latest backup.

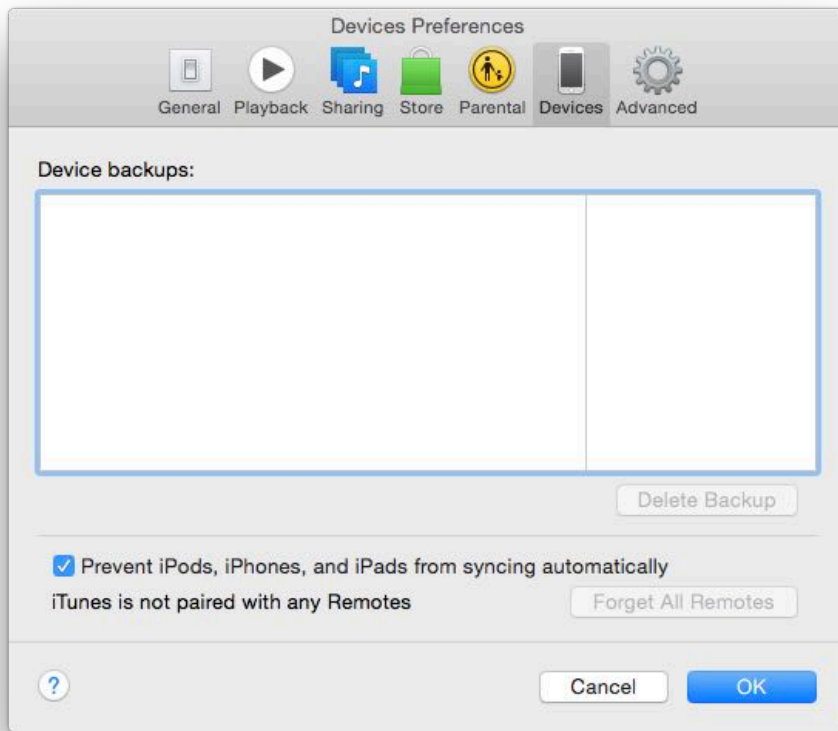


Learn more about iCloud at [www.apple.com/icloud](http://www.apple.com/icloud). Refer to article [HT207428: What does iCloud back up?](#)

### iTunes on user's computer

1. Connect the user's device to the user's computer.
2. Open iTunes.
3. Select Preferences.
4. Select Devices.
5. Verify the latest backup in the "Device backups" pane.

**Important:** To avoid syncing a user's device to a test computer, go to iTunes > Preferences > Devices and select "Prevent iPods, iPhones, and iPads from syncing automatically."



Also refer to the following articles:

- [HT203977: How to back up your iPhone, iPad, and iPod touch](#)
- [HT201274: How to erase your iPhone, iPad, or iPod touch](#)
- [HT203271: If your iTunes backup couldn't be completed or you can't restore from a backup](#)

# Cleaning Procedures

## Contents

This article includes the following sections:

- Required Tools
- Dock or Lightning Connector - iPhone, iPad, iPod
- Headphone/Headset Jack
- Speaker and Microphone
- Receiver - iPhone only
- SIM Tray
- Loop Holder - iPod touch (5th generation) only
- Lightning Connector - AirPods Charging Case
- Internal AirPods Charging Case

## Required Tools

- Lighted otoscope (or lighted magnifying glass)
- ESD-safe brush (922-9918)
- ESD-safe tweezers
- Microfiber cloth
- Compressed air (for AirPods lightning connector only)
- Foam swab
- Isopropyl alcohol (IPA) wipe



**Caution:** Never use compressed air to clean any part of an iPhone, iPad, or iPod, as this can damage delicate components.

## Dock or Lightning Connector - iPhone, iPad, iPod

Debris in the dock or Lightning connector can cause performance issues, such as:

- Unable to charge battery.
- Device not recognized by iTunes/computer/accessory.

Cleaning Procedure:

1. Power off the device.
2. Use a lighted otoscope or magnifying glass to inspect for debris.
3. Use an ESD-safe brush to delicately brush out lint or debris. Be careful not to damage any metal contacts.  
**Note:** Avoid brushing debris into the speaker or microphone, if present, on either side of the dock or Lightning connector.
4. If needed, use ESD-safe tweezers to carefully pull out any large pieces of lint or debris. Be careful not to damage any metal contacts.



### Headphone/Headset Jack

Debris in the headphone/headset jack can cause audio or functional issues, such as:

- Device is stuck in headphone mode and no audio is heard from receiver (if present) or speaker.
- Headphone audio is distorted (static or crackles) or is not functioning.
- Headphone audio is only heard in one channel.
- Headphone microphone has distorted sound or no sound.
- Headphone connector will not fit all the way into headphone/headset jack.



**Warning:** Do not use long metal tools (such as screwdrivers or dental picks) while cleaning inside the headphone/headset jack, as this could lead to battery puncture.

1. Use a lighted otoscope or magnifying glass to inspect for debris.
2. Use an ESD-safe brush to brush out lint or debris. Use just enough bristles to fit inside the headphone/headset jack. Twist the bristles to loosen and lift out debris.



### Speaker and Microphone

Debris blocking the speaker and microphone openings can cause audio performance issues, such as:

- Low or distorted volume audio from the speaker.
- Muffled, low volume, or distorted audio recorded from the microphone.

Cleaning Procedure:

1. Use an ESD-safe brush to gently brush cover openings of the speaker and/or microphone, if present.  
**Note:** Avoid brushing debris into the dock or Lightning connector by brushing debris away from the connector.



### Receiver - iPhone only

Debris blocking the receiver opening can cause audio performance issues, such as:

- Muffled, low volume, or distorted audio through the receiver.

Cleaning Procedure:

1. Inspect the receiver for loose debris.
2. Use an ESD-safe brush to **gently** brush the cover mesh in the receiver opening to remove debris.  
**Caution:**
  - Use extreme care to avoid damaging the microphone embedded within the receiver opening.
  - Avoid using large sweeping motions across the glass, as this could lead to scratches.
3. Use a microfiber cloth to clean away the loosened debris.



### SIM Tray

Dirt and debris around SIM tray slot of the device can appear dirty and cause issues, such as:

- Difficulty opening/closing SIM tray.
- Dirt and debris entering device when SIM tray is ejected and removed.

1. Eject SIM tray from device.





2. Use alcohol wipe to gently wipe around edges of SIM tray to remove dirt from edges.
3. Use alcohol wipe to gently wipe around edges of SIM tray slot on device to remove dirt from edge.
4. Inspect to verify dirt has been removed.
5. If any dirt still remains, use alcohol wipe and repeat steps 2 and 3.



#### **Loop Holder - iPod touch (5th generation) only**

Debris blocking the loop holder can cause functional issues, such as:

- Loop holder does not respond to touch.
  - Loop holder does not open/close.
1. Use an ESD-safe brush to delicately brush out lint or debris. If needed, use ESD-safe tweezers to pull out any large pieces of lint or debris.



#### **Lightning Connector - AirPods Charging Case**

Debris in the Lightning connector can cause this performance issue:

- Unable to charge the case battery.

#### Cleaning Procedure:

1. Use a lighted otoscope or magnifying glass to inspect for debris.
2. Blow away any loose debris with compressed air.



3. If debris still remains, use an ESD-safe brush to delicately brush out debris.



4. If needed, use ESD-safe tweezers to carefully pull out any large pieces of debris.  
**Caution:** Be careful not to damage any metal contacts.
5. Use compressed air to remove any remaining loose debris.
6. Clean the outside of the case with a microfiber cloth.



#### Internal AirPods Charging Case

Contaminated contacts or debris in the AirPods wells can cause this performance issue:

- Unable to charge the AirPods

**Caution:** Do not use compressed air to clean inside the AirPods wells as this can cause debris to get stuck behind the contacts.

1. Use a lighted otoscope or magnifying glass to inspect the AirPods wells for debris and the contacts for contamination.



2. Open an IPA wipe packet and insert the foam end of the swab.



3. Press the foam end of the swab inside the IPA wipe packet to transfer enough alcohol to moisten it.



4. Use the moist foam swab to very gently rub the contacts in a vertical up-and-down motion.  
**Caution:** To protect the spring finger contacts, do not twirl the swab or excessively force it on the contacts.



5. Gently clean out any other debris in the wells or inside the charging case.



# Accessories

## Accessories included with iPhone 7, 7 Plus, 8, 8 Plus, X:

- 5W USB Power Adapter
- EarPods with Lightning Connector
- Lightning to 3.5 mm Headphone Jack Adapter
- Lightning to Micro USB Adapter (Some countries)
- Lightning to USB Cable (1 m)

## Accessories included with iPhone 6, 6 Plus, 6s, 6s Plus:

- 5W USB Power Adapter
- EarPods with 3.5 mm Headphone Plug
- Lightning to Micro USB Adapter (Some countries)
- Lightning to USB Cable (1 m)

## Additional accessories (not included):

- Lightning to USB Cable (0.5 m)
- Lightning to USB Cable (2 m)
- Lightning to 30-pin Adapter
- Lightning to 30-pin Adapter (0.2 m)
- Lightning Digital AV Adapter
- Lightning to VGA Adapter
- Lightning to SD Card Camera Reader
- Lightning to USB Camera Adapter
- Lightning to USB 3 Camera Adapter
- iPhone Lightning Dock
- Leather Case\*
- Silicone Case\*
- [iPhone 6s Smart Battery Case](#)
- [iPhone 7 Smart Battery Case](#)
- [AirPods](#)

**\*Service Strategy for Leather and Silicone Cases:** Leather and silicone cases are available as out-of-warranty service parts. To identify conditions which may affect warranty coverage, refer to article [SM268: Visual/Mechanical Inspection \(VMI\) Guide for Apple Cases and Covers](#).

## 5W USB Power Adapter

- Ultracompact design
- Fast, efficient charging



## EarPods

- Built-in remote to adjust volume, control music and video playback, and answer or end calls
- Designed to rest comfortably inside a variety of ear sizes
- Speakers inside are designed to minimize sound loss and maximize sound output



### Lightning to USB Cable

- USB 2.0
- Connects iPhone, iPad, or iPod (with Lightning connector) to a computer's USB port to sync and charge, or to a USB Power Adapter to charge from a wall outlet
- Reversible design



### Lightning to 3.5 mm Headphone Jack Adapter

- Connect devices that use a 3.5 mm audio plug to a Lightning device
- Supports analog audio output
- Compatible with iPhone 5 and later, running iOS 10 or later



### Lightning to Micro USB Adapter

- Connects devices with a Lightning connector to micro USB cables and chargers to sync and charge your device



### Lightning to 30-pin Adapter

- Connects devices with a Lightning connector to many 30-pin accessories\*
- Supports analog audio output and USB audio, as well as syncing and charging
- Video output is not supported

\*Some 30-pin accessories are not supported



### Lightning to 30-pin Adapter (0.2 m)

- Connects devices with a Lightning connector to many 30-pin accessories\*
- Supports analog audio output and USB audio, as well as syncing and charging
- Video output is not supported

\*Some 30-pin accessories are not supported



### Lightning Digital AV Adapter

- Supports mirroring of a device's screen to a HDMI-equipped TV, display, projector, or other compatible display in up to 1080p HD
- Requires a HDMI cable (sold separately) for connection to a TV or projector
- Supports both video and audio output



### Lightning to VGA Adapter

- Supports mirroring of a device's screen to a VGA-equipped TV, display, projector, or other compatible display in up to 1080p HD
- Requires a VGA cable (sold separately) for connection to a TV or projector
- Does not support audio output





### Lightning to SD Card Camera Reader

- Downloads photos and videos from a digital camera
- Supports standard photo formats, including JPEG and RAW, along with SD and HD video formats, including H.264 and MPEG-4
- Compatible with iPhone 5 and later



### Lightning to USB Camera Adapter

- Downloads photos and videos from a digital camera
- Supports standard photo formats, including JPEG and RAW, along with SD and HD video formats, including H.264 and MPEG-4
- Compatible with iPhone 5 and later



### Lightning to USB 3 Camera Adapter

- Downloads photos and videos from a digital camera
- Supports standard photo formats, including JPEG and RAW, along with SD and HD video formats, including H.264 and MPEG-4
- Compatible with iPhone 5 and later

**Note:** The Lightning to USB 3 Camera Adapter transfers data at USB 3 speeds when connected to an iPad Pro 12.9-inch. All other iOS devices transfer at USB 2 speeds.



### iPhone Lightning Dock

- Connects iPhone to a computer to sync and charge, or to the Apple USB Power Adapter to charge from a wall outlet using a Lightning to USB Cable
- 3.5 mm audio port, supports headphones with remote control or line-out
- Available in a variety of colors
- Compatible with iPhone 5 and later



### Leather Case

- Leather exterior with soft microfiber lining
- Available in two sizes and a variety of colors



### Silicone Case

- Silicone exterior with soft microfiber lining
- Available in two sizes and a variety of colors



# AirPods - Overview and Visual/Mechanical Inspection (VMI) Guide

This article contains the following sections

- Overview
- Service Considerations
- AirPods Charging Case Button Functions
- Functional Test
- Visual/Mechanical Inspection
- Troubleshooting Symptom Charts

## Overview

### AirPods



- Automatically on, automatically connected
- One-tap setup for all your Apple devices
- Control music and video playback
- Answer and end calls
- Compatible with:
  - iPhone, iPad, and iPod touch models with iOS 10 or later
  - Apple Watch models with watchOS 3 or later
  - Mac models with macOS Sierra or later
- Seamless switching between devices

### AirPods Charging Case

- Built-in battery
- Charges AirPods



## Service Considerations

When replacing either the left or right AirPods, the new AirPods need to be connected to the customer's other AirPods. Put both AirPods into the charging case and follow instructions on the screen of the connected iPhone. If a connected iPhone is not available, hold the button on the back of the charging case until the LED flashes amber. This will connect the two AirPods and will also reset them to factory default settings.

Configure AirPods using software settings on the connected iPhone in **Settings > Bluetooth** for the following functions:

- Double-tap
  - Siri
  - Play/Pause
  - Off
- Automatic Ear Detection
  - On/off

- Microphone
  - Automatically Switch AirPods
  - Always Left AirPods
  - Always Right AirPods

Charging case status light colors:

- Flashing white when in setup mode
- Flashing amber when buds in the case are not connected to each other
- Solid amber when charging
- Solid green when fully charged
- Off when the case has been plugged in to a power adapter for longer than six hours

### AirPods Charging Case Button Functions

- Hold the button until LED flashes white to enter discovery mode and pair to a new device.
- The case is required to set up AirPods. Hold the button on the back until LED flashes white.
- The case is required to restore AirPods to factory default settings. Hold the button on the back until LED flashes amber.

### Functional Test

#### Test Pairing and Bluetooth

1. Setup AirPods to a known-good device. Press and hold the button on charging case until the LED flashes white, then hold close to a known-good device. Follow onscreen instructions.
2. Check in **Settings > Bluetooth** to verify AirPods are connected. **Note:** The charging case should be open or one or both AirPods should be out of the case.
3. Place AirPods in ears.
4. Play music to verify proper audio routing.

#### Test Touch Gesture

1. Double-tap either AirPods to access Siri. **Note:** Check the double-tap settings on the connected iPhone in **Settings > Bluetooth**.

#### Test Sound Quality

1. Listen to music for sound quality.
2. Set microphone to Always Left AirPods in **Settings > Bluetooth**.
3. Make a test phone call to an approved toll-free number. During the call, verify the sound quality of the receiver and the microphone.
4. Set microphone to Always Right AirPods and repeat step 3.

#### Test Charging

1. Place both AirPods in the charging case.
2. Connect a Lightning cable to the charging case. Connect the other end of the Lightning cable to a USB power adapter or the USB port on a computer.
3. Verify that the LED on the charging case turns solid amber (or solid green, if case and AirPods are both already fully charged).

### Visual/Mechanical Inspection

#### Device Wear

The warranty does not apply to cosmetic damage (including, but not limited to, scratches, dents, and broken plastic on ports), or to defects caused by normal wear and tear or otherwise due to the normal aging of the device. If no hardware issue is present and cosmetic damage is the only reported issue, then deny a repair or replacement.

Examples of wear:

- Discoloration and/or staining
- Cracks, marks, or scratches

#### Service Eligibility Guidelines

The chart below outlines the service eligibility of different types of damage.

Eligible for Warranty Service	<p>If the damage for which the user is seeking service is described below, then the device is eligible for warranty service. If the AirPods also have accidental or liquid damage, then a whole-unit replacement should be performed under warranty.</p> <ul style="list-style-type: none"> <li>• Swollen battery: Including deformation or case separation due to a swollen battery.</li> </ul>
Eligible for Out-Of-Warranty Service (Returnable Damage)	<p>If the damage (or combination of damages) for which the user is seeking service is described below, then the device is eligible for out-of-warranty service.</p> <ul style="list-style-type: none"> <li>• Damaged Lightning connector: Foreign material that cannot be removed, including broken accessories, bent pins, broken plastic, or a bent bezel.</li> </ul>
Ineligible for Service (Nonreturnable Damage)	<p>If the damage for which the user is seeking service is described below, then the device is ineligible for service. Return the device to the user.</p> <ul style="list-style-type: none"> <li>• Disassembled unit or missing parts: To receive service, the unit must have all functional parts and must be assembled.</li> <li>• Catastrophic damage: Includes units that are destroyed or forcibly separated into multiple pieces.</li> <li>• Counterfeit parts; damage caused by counterfeit parts, third-party parts, or unauthorized modifications: Damage caused by unauthorized modifications is ineligible for warranty or out-of-warranty service.</li> </ul>

## Troubleshooting Symptom Charts

### Accessories

- [Accessory Issues](#)
- [Missing or Lost Audio Accessory](#)

### Connectivity

- [Control Issues](#)
- [Wireless Connection Issues](#)

### Mechanical

- [Physical Damage Issues](#)
- [Unusual Heat or Odor](#)

### Power

- [Power Issues](#)

### Sound

- [Microphone Issues](#)
- [Sound Issues](#)

## Additional Resources

### **iPhone Product Page**

iPhone features and technology.

[www.apple.com/iphone](http://www.apple.com/iphone)

### **iPhone Support Page**

Information, guides, assistants, and troubleshooting tips.

[www.apple.com/support/iphone](http://www.apple.com/support/iphone)

### **iPhone Tech Specs**

System requirements, supported languages, media formats, and technical details.

[support.apple.com/specs/iphone](http://support.apple.com/specs/iphone)

### **iPhone User Guide**

Easy to access, in-depth usage instructions for features and settings.

[support.apple.com/manuals/iphone](http://support.apple.com/manuals/iphone)

### **iTunes Support Page**

[www.apple.com/support/itunes](http://www.apple.com/support/itunes)

### **Apple Batteries**

[www.apple.com/batteries](http://www.apple.com/batteries)



# Contactless Payment Reader

The Contactless Payment reader is used to verify the functionality of the Apple Watch and iPhone 6, 6 Plus, 6s, 6s Plus, SE, 7, 7 Plus, 8, 8 Plus, and X Apple Pay hardware only. The reader will not gather any payment data or information. The test will not charge the user's payment card and will not detect an issue with the user's account or bank systems.

## Running the Apple Pay Test

1. Connect the Contactless Payment reader to an open USB port on a computer.
2. Hold the Apple Watch or top of the iPhone near the reader. If using an Apple Watch, then double-click the side button to activate Apple Pay.
3. If the user is present, then ask him or her to authorize Apple Pay. **Note:** This will not charge the user's payment card.

## Results

- If the user authorizes the test, then the light on the reader will turn green and the reader will beep. This indicates that the hardware is functional.
- If the user does not authorize the test, then the light will stay red but the iPhone will continue to ask for authorization. This indicates that the hardware is functional.

If neither result occurs, then the hardware may not be functional. To continue troubleshooting, refer to articles:

- [IT1150: Apple Watch: Apple Pay Issues](#)
- [IT1144: iPhone 6 and 6 Plus: Apple Pay Issues](#)
- [IT1210: iPhone 6s, 6s Plus, and SE: Apple Pay Issues](#)
- [IT1398: iPhone 7, 7 Plus, 8, 8 Plus, X: Apple Pay Issues](#)

# Common Troubleshooting Procedures

When troubleshooting, attempt the common troubleshooting procedures in the order listed in the table below. Click the name of a quick fix procedure for detailed information.

## Important:

- These steps may not be effective for all issues. Apply only the steps necessary to isolate and resolve the user's issue.
- Before servicing a device, ensure that the customer has disabled Find My iPhone in Settings. For more information, refer to article [HT201365: Find My iPhone Activation Lock](#).

Procedure	Action
<b>Update to Latest Software</b>	<p>Go to Settings &gt; General &gt; Software Update, if available; or</p> <p>Use the latest version of iTunes (<a href="http://www.apple.com/itunes/download">www.apple.com/itunes/download</a>) to check for the latest iOS. Connect the device to the computer, go to iTunes &gt; (Device) &gt; Summary, and click the "Check for Update" button.</p>
<a href="#">Charge Battery</a>	<p>Connect to a known-good power outlet, using a known-good Apple USB Power Adapter and Lightning to USB Cable to charge the battery. Do not charge via a computer port or wireless charging.</p> <p><b>Note:</b> The device may have entered a deep discharge state that requires 20–30 minutes of charging to turn on. The battery trap should be visible within two minutes on the screen while charging.</p>
<a href="#">Force an App to Close</a>	<p>iPhone 8 and earlier, iPad, and iPod touch:</p> <ol style="list-style-type: none"><li>1. Double-click the Home button to see preview screens of recently used apps.</li><li>2. Swipe the app's preview screen up and out of the preview.</li></ol> <p>iPhone X:</p> <ol style="list-style-type: none"><li>1. Slide up from the bottom of the screen to see preview screens of recently used apps.</li><li>2. Tap and hold on a app preview screen until the minus button appears.</li><li>3. Tap the minus button or swipe the app's preview screen up and out of the preview.</li></ol>

<a href="#"><u>Restart</u></a>	<p>A restart forces the device to close all open files and turns off all hardware components.</p> <p>For all devices running iOS 11:</p> <ol style="list-style-type: none"> <li>1. Choose Settings &gt; General &gt; Shut Down.</li> <li>2. Slide your finger across the slider to turn off the device.</li> <li>3. To turn the device on, press and hold the Sleep/Wake or Side button until the Apple logo appears.</li> </ol> <p>iPhone 8 and earlier, iPad, and iPod touch:</p> <ol style="list-style-type: none"> <li>1. Press and hold the Sleep/Wake or Side button until a slider appears.</li> <li>2. Slide your finger across the slider to turn off the device.</li> <li>3. To turn the device on, press and hold the Sleep/Wake or Side button until the Apple logo appears.</li> </ol> <p>iPhone X:</p> <ol style="list-style-type: none"> <li>1. Press and hold the Volume Down button and the Side button until a slider appears.</li> <li>2. Slide your finger across the slider to turn off the device.</li> <li>3. To turn the device on, press and hold the Side button until the Apple logo appears.</li> </ol>
<a href="#"><u>Reset</u></a>	<p><b>Perform a reset only if unable to do a restart.</b></p> <p>Press and hold the following two buttons together for at least 10 seconds, until the Apple logo appears.</p> <ul style="list-style-type: none"> <li>• iPhone 6s or earlier, iPad, and iPod touch: Sleep/Wake button and Home button.</li> <li>• iPhone 7: Side button and Volume down button.</li> <li>• iPhone 8 and X: Press and quickly release the Volume Up button. Then press and quickly release the Volume Down button. Then press the Side button for about six seconds, until the screen goes black. Finally, press and hold the Side button until you see the Apple logo.</li> </ul>
<a href="#"><u>Erase All Content and Settings</u></a> *	<p>Erases all user content and settings, including installed apps. From the Home screen, choose Settings &gt; General &gt; Reset &gt; Erase All Content and Settings. If possible, try this before a restore because it is much faster.</p>
<a href="#"><u>Restore</u></a> *	<p>Erases all software and data and installs a fresh copy of iOS. Connect the device to the computer, go to iTunes &gt; (Device) &gt; Summary, and click the “Restore” button.</p>
<a href="#"><u>Recovery Mode Restore</u></a> *	<p>Recovery mode loads only the firmware drivers necessary for iTunes to recognize the device. Click the link at left for instructions.</p>

**\*Caution: This will delete all user data and settings on the device. If saving content is important to the user, a backup should be made before beginning this process.** If restoring user data from either an iCloud or iTunes backup causes an issue to return, there is no reason to restore from the other backup method as it will lead to the same result.

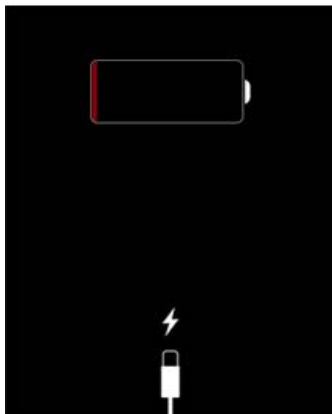
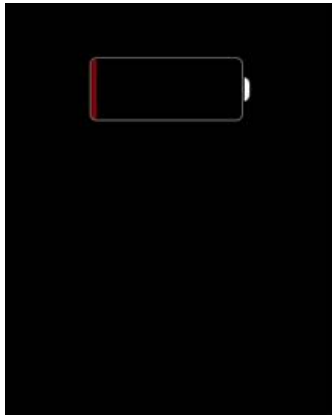
DF Reset and DFU Restore are not necessary to troubleshoot iOS devices. Restore and Recovery Mode Restore take less time to accomplish the same result. If the device will not go into Recovery Mode or will not charge, then follow the troubleshooting steps in the Service Guide.

# Charge Battery

The device must have sufficient battery charge to proceed with troubleshooting. A low battery condition can cause many issues.

If the device has any of the following symptoms, it should be connected to an Apple USB Power Adapter to charge for at least 10 minutes:

- Will not turn on
- Black screen
- Shows the “battery trap” image
- Low battery charge



**Note:** If the device is extremely low on power, the display may be blank for up to two (2) minutes before one of the low-battery images appears. An Apple USB Power Adapter delivers more power than the USB ports of some computers, so the power adapter is the recommended initial charging method for a low battery. Once the device has started up to the iOS, it can be disconnected from the power adapter and connected to a computer.


If troubleshooting or testing will be performed without the device connected to power, check that the device has a sufficient charge before continuing.

## Important:

- Before connecting any cable to the dock connector, Lightning connector, or headset jack, check the port connections for debris, contamination, corrosion, liquid, or damage. Clean or remedy these issues before connecting any cables.
- If the device becomes too hot while charging, disconnect and replace the device.
- Only use a known-good Apple USB Power Adapter when charging from a power outlet. While other power adapters may appear to be compatible, their lower power output is not sufficient to charge the device.
- The battery icon in the upper right corner of the screen shows the battery charging status and approximately how much charge is left in the battery. When the device is connected to a power source, a small lightning bolt icon will appear next to the battery icon.



**Note:** An iPad may take longer to charge while syncing or using the iPad. If the iPad is connected to a source that does not provide enough power to sufficiently charge the device, the notification “Not Charging” appears next to the battery indicator in the status bar (top right corner).

Not Charging 

Refer to the following articles for more information:

- [HT201569: If your iPhone, iPad, or iPod touch won't charge](#)
- [HT201264: About the battery usage on your iPhone, iPad, and iPod touch](#)
- [www.apple.com/batteries](#)

# Force an App to Close

This procedure forces an app to close that is not responding to input or does not perform as expected. This is a recommended first troubleshooting step.

## iPhone X:

1. Slide up from the bottom of the screen to see preview screens of recently used apps.
2. Tap and hold on a app preview screen until the minus button appears.
3. Tap the minus button or swipe the app's preview screen up and out of the preview.

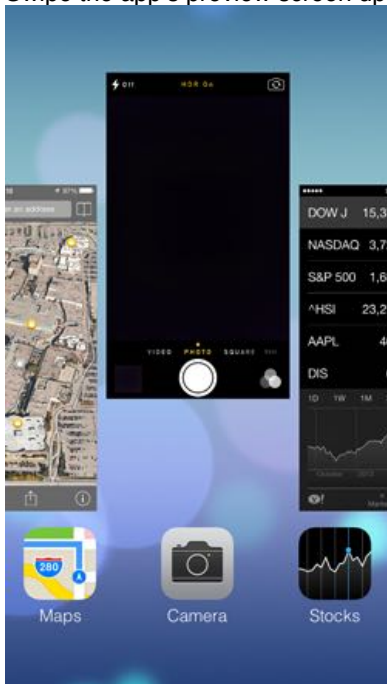
## Procedure for iOS 9 and later:

1. Double-click the Home button to see preview screens of recently used apps.
2. Swipe the app's preview screen up and out of the preview.



## Procedure for iOS 7 and iOS 8:

1. Double-click the Home button to see preview screens of recently used apps.
2. Swipe the app's preview screen up and out of the preview.



Refer to the following articles for more information:

- [HT201330: How to force an app to close on your iPhone, iPad, or iPod touch](#)
- [HT202070: Switch apps on your iPhone, iPad, or iPod touch](#)
- [HT201398: If an app you installed unexpectedly quits, stops responding, or won't open](#)



# Restart

A restart properly saves user data, closes down all open applications and powers off all hardware components, then restarts the device.

A restart can quickly resolve a wide range of issues, including:

- App(s) unexpectedly quit.
- Battery life is shorter than expected.
- Hardware not performing as expected.
- Interface or apps are slow to respond.
- iTunes does not recognize or sync with the device.

## Procedure:

For all devices running iOS 11:

1. Choose Settings > General > Shut Down.
2. Slide your finger across the slider to turn off the device.
3. To turn the device on, press and hold the Sleep/Wake or Side button until the Apple logo appears.

iPhone 8 and earlier, iPad, and iPod touch:

1. Press and hold the Sleep/Wake or Side button until a slider appears.
2. Slide your finger across the slider to turn off the device.
3. To turn the device on, press and hold the Sleep/Wake or Side button until the Apple logo appears.

iPhone X:

1. Press and hold the Volume Down button and the side button until a slider appears.
2. Slide your finger across the slider to turn off the device.
3. To turn the device on, press and hold the side button until the Apple logo appears.

**Note:** If you cannot restart the device because it is unresponsive, a [Reset](#) is the next appropriate troubleshooting step.

# Reset

If the device is unresponsive and restart does not work, try to reset it.

**IMPORTANT: Perform a reset ONLY if unable to do a restart.**

## Key Points:

- Reset only when you cannot restart the device normally.
- A reset removes all power for a fraction of a second to power off the device.
- A reset does not close open files or save data before the device powers off.
- **CAUTION: A reset can potentially cause file or operating system damage, requiring a restore.**

## Procedure:

1. Press and hold the following two buttons together for at least 10 seconds, until the Apple logo appears.
  - iPhone 6s or earlier, iPad, and iPod touch: Sleep/Wake button and Home button.
  - iPhone 7: Side button and Volume down button.
  - iPhone 8 and X: Press and quickly release the Volume Up button. Then press and quickly release the Volume Down button. Then press the Side button for about six seconds, until the screen goes black. Finally, press and hold the Side button until you see the Apple logo.

# Erase All Content and Settings

Erase All Content and Settings is a quick way to get a device back to factory settings. It will delete all user content and settings, but does not reinstall iOS like a restore does. Erase All Content and Settings can resolve software issues more quickly than a time-consuming restore.

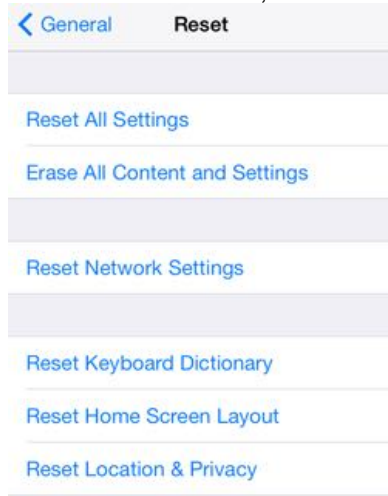


**Caution:** This will delete all user data and settings on the device.

**Important:** Before servicing a device, ensure that the customer has disabled Find My iPhone in Settings. For more information, refer to article [HT201365: Find My iPhone Activation Lock](#).

## Procedure:

1. From the Home screen, choose Settings > General > Reset > Erase All Content and Settings.



Also see article [HT201274: How to erase your iPhone, iPad, or iPod touch](#).

If Erase All Content and Settings does not resolve an issue, proceed with a [Restore](#).

# Restore

A restore completely erases the device and reinstalls a fresh copy of iOS.



**Caution:** This will delete all user data and settings on the device.

**IMPORTANT:** Before servicing a device, ensure that the customer has disabled Find My iPhone in Settings. For more information, refer to article [HT201365: Find My iPhone Activation Lock](#).

## Key Points:

- A restore erases all user content, settings, and iOS files, and then reinstalls only iOS.
- A restore is time-consuming, especially if you have to download the restore package.
- If iTunes displays an alert with an error code, refer to articles:
  - [HT204770: Get help with iOS update and restore errors](#)
  - [HT201210: If you see an error when you update or restore your iPhone, iPad, or iPod](#)
- When the restore is complete, test the device before restoring a backup or syncing content. Refer to articles:
  - [HT204136: About backups for iOS devices](#)
  - [HT203977: How to back up your iPhone, iPad, and iPod touch](#)

**Note:** Do not set up as a new device, as this can erase previous backups. Copy or rename the backup folder before proceeding. Refer to article [HT201252: Restore your iPhone, iPad, or iPod to factory settings](#).

## Procedure:

1. Connect the device to a computer running the latest version of iTunes.
2. In the left column under Devices, click on the device name, then go to the Summary panel and click the Restore button.



# Recovery Mode Restore

If iTunes cannot detect the device or a specific restore error appears, check the cable connections. If the issue persists, consider forcing the device into recovery mode.



**Caution:** This will delete all user data and settings on the device.

If you cannot restore a device, even when using recovery mode, service or replacement may be the appropriate option.

**Note:** If the device is connected to iTunes, updating the software may resolve an issue without erasing settings and content. If updating the software does not work, it may be necessary to restore the device, which will erase all settings and content.

**Important:** Before servicing a device, ensure that the customer has disabled Find My iPhone in Settings. For more information, refer to article [HT201365: Find My iPhone Activation Lock](#).

## Key Points

- Recovery mode loads only the firmware drivers necessary for iTunes to recognize the device.
- To force the device into recovery mode, turn off the device, then connect it to a USB port on the computer while holding the Home button (iPhone 6s or earlier, iPad, and iPod touch), Volume down button (iPhone 7 and 7 Plus), or Side button (iPhone 8, 8 Plus, and X).
- If the device does not turn off, then try a [reset](#) to turn it off.
- If iTunes displays an alert with an error code, then refer to the following articles:
  - [HT204770: Get help with iOS update and restore errors](#)
  - [HT201210: If you see an error when you update or restore your iPhone, iPad, or iPod](#)

**Note:** In certain situations, a device will automatically go into recovery mode after an update or restore issue. If the device is already in recovery mode, then attempt to restore the device using iTunes.

## Procedure:

Use the following steps to place a device into recovery mode. If the device is already in recovery mode, start at step 6.

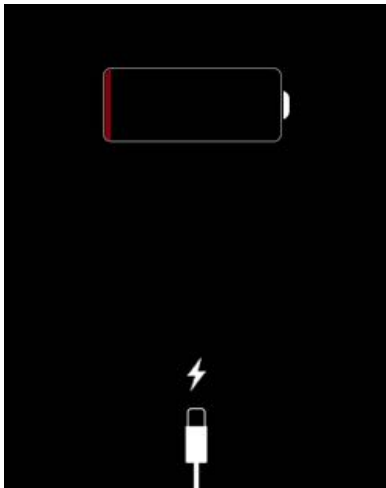
1. Disconnect the USB cable from the device, but leave the other end of the cable connected to the computer's USB port.
2. Turn off the device: Press and hold the Sleep/Wake or Side button for a few seconds until the red slider appears, then slide the slider. Wait for the device to turn off.

**Note:** If you cannot turn off the device using the slider, then perform a reset:

- a. Use the following button sequences:
    - iPhone 6s or earlier, iPad, and iPod touch: Sleep/Wake button and Home button
    - iPhone 7 and 7 Plus: Side button and Volume down button
    - iPhone 8, 8 Plus, and X: With the device plugged into a computer with iTunes open, press and quickly release the Volume Up button. Then press and quickly release the Volume Down button. Then press the Side button for about six seconds, until the screen goes black. Finally, press and hold the Side button until you see the Apple logo.
  - b. When the device turns off, release the Sleep/Wake or Side button and continue holding the Home button (iPhone 6s or earlier, iPad, and iPod touch) or Volume down button (iPhone 7).
3. While pressing and holding the Home button (iPhone 6s or earlier, iPad, and iPod touch), Volume down button (iPhone 7 and 7 Plus), or Side button (iPhone 8, 8 Plus, and X), reconnect the USB cable to the device. When you reconnect the USB cable, the device should turn on.

**Note:** If you see the "battery trap" image (below), let the device charge for at least 10 minutes to ensure that the battery has some charge, then repeat step 2.

3.



4. Continue holding the button until you see the “Connect to iTunes” screen (below). When this screen appears, you can release the button.



5. If necessary, open iTunes. You should see an alert that iTunes has detected a device in recovery mode.  
6. Use iTunes to restore the device.



If you do not see the “Connect to iTunes” screen, try these steps again. If you see the “Connect to iTunes” screen but the device does not appear in iTunes, refer to article [HT204095: If iTunes doesn't recognize your iPhone, iPad, or iPod](#).

If you decide not to do a restore, you may be able to exit recovery mode by resetting the device.

# Take-Apart General Information

## Before You Begin

- **Important: Refer to the Visual/Mechanical Inspection (VMI) Guide to determine whether the device has any accidental damage.** Check for Liquid Contact Indicator (LCI) activation before opening the device. One externally visible LCI can be viewed by removing the SIM tray.
- Remove any cases or screen protectors, as they may inhibit proper testing.
- Verify the user-reported symptom(s) and identify the correct part(s) needed for repair.
- Ensure that the device is turned off (by using the red slider).

## Electrostatic Discharge (ESD) Precautions

Proper ESD precautions must always be used when opening an iPhone. Make sure you are working on a properly grounded ESD-safe mat and are wearing a properly connected ESD-safe wrist strap.

For more information about ESD, refer to:

- [OP100: Electrostatic Discharge Precautions and Myths](#)
- [ATLAS: ESD Precautions](#)

## Required Tools

The following tools are required to service iPhone 6 and later:

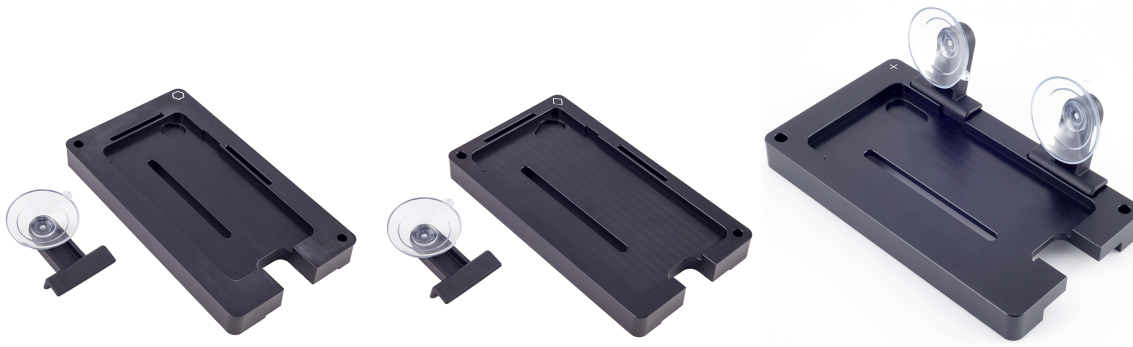
- ESD-safe brush (922-9918)
- ESD-safe tweezers
- ESD-safe wrist strap
- ESD-safe workstation
- 4.7-inch Repair Tray\* (923-01918)
- 5.5-inch Repair Tray\* (923-01919)
- 5.8-inch Repair Tray\* (923-01920)
- iPhone Battery Fixture (923-01917)
- iPhone torque driver (blue), 0.65 kg-fcm (923-0448)
- iPhone torque driver (gray), 0.55 kg-fcm (923-00738)
- iPhone torque driver (green), 0.45 kg-fcm (923-00105)
- iPhone torque driver kit (923-0248) includes:
  - iPhone torque driver (black), 0.35 kg-fcm
  - iPhone Torx security bit (923-0247)
  - JCIS bit (923-0246) for cross-head screws
- MicroStix bit (923-01290)
- Superscrew bit (923-01289)
- 2.1 mm superscrew bit (923-02066)
- Microfiber polishing cloth
- Motorola DS4208 scanner (923-0445) for serial bar code
- Black stick (922-5065)
- Packing tape (provides a smooth surface for removal of the display)
- SIM removal tool (922-8417) or paper clip (size #1)
- Universal Display Removal Fixture (923-00066)

The following tools are required to service iPhone 6s, 6s Plus, 7, 7 Plus, 8, 8 Plus, X only:

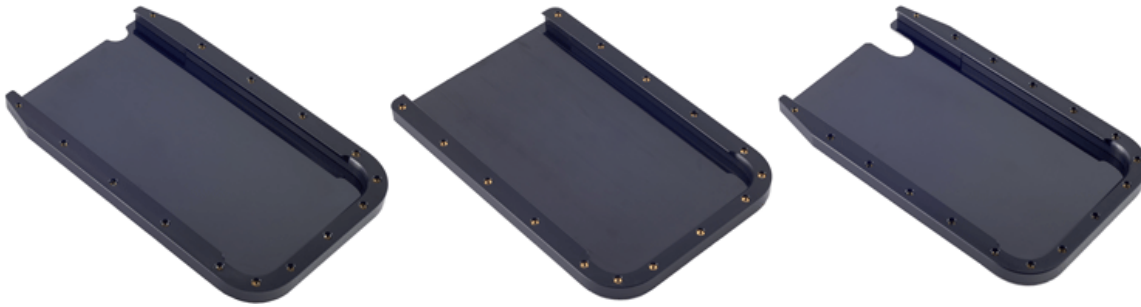
- iPhone 6s and 6s Plus Display Removal Fixture Adapter (923-00652)
- Display Press (661-08916)
- Display Adhesive Cutter (923-01915) and Wheel (923-01916)

Refer to article [OP1082: Hand tools for repairs](#) for more details.

**\*Note:** The 4.7-inch Repair Tray is marked with a hexagon on one corner. The 5.5-inch Repair Tray is marked with a diamond on one corner. The 5.8-inch Repair Tray is marked with a plus sign on one corner.



Use the support frame when the back glass is broken on an iPhone 8, 8 Plus, and X. **Important:** Apply Back Protective Cover before placing device in the support frame.





# Device Safety

## Battery Handling

iPad, iPhone, iPod, Apple Watch include a lithium-polymer rechargeable battery. The battery, when used and repaired under reasonable conditions and according to instructions, should not present a health hazard. The contents of the battery are encapsulated. However, if the contents are released or damaged, they may present potential health and safety hazards. Avoid exposure to heat and open flame. Do not puncture, deform, crush, or incinerate, as a thermal runaway reaction and excessive heating may result. Refer to article [OP24: Safely handling lithium batteries and lithium battery-powered devices](#). For workstation setup and special battery handling tools refer to the Workstation and Special Tools section of article [OP685: About embedded battery safety](#).



**Warning: If the battery is dented, punctured, swollen, or otherwise damaged, then stop the repair. Do not remove the battery from the device. Replace the whole unit.**

For further instructions about swollen batteries, including warranty coverage, refer to article [HT204762: Enclosure separation due to expanded battery](#).

**Warning: Do not reuse or reinstall a loose battery or a battery that has been removed. Replace it with a new battery. If a new battery is unavailable, replace the whole unit.**

## Thermal Runaway Events Involving Lithium-Ion (LiO) / Lithium-Polymer Batteries

The following statements are intended for guidance purposes only. Only properly trained and equipped personnel should respond to a thermal runaway event.

The most effective way to prevent a lithium-ion/lithium-polymer battery thermal event is to discharge the battery before opening the device or working on or near the battery. (A battery with a charge of less than 25% will be unable to produce a thermal event.)

If a battery begins to emit smoke or sparks, or if you hear hissing or popping sounds, the battery is most likely undergoing a thermal runaway. The most effective way to stop the reaction is to smother it IMMEDIATELY with plenty of clean, dry sand. As soon as you notice that a battery thermal event is underway, pour all of the sand, all at once, over the battery to cover it completely. This will smother the reaction and limit the amount of smoke produced.

Do not attempt to use water or an ABC/CO2 fire extinguisher on a thermal runaway battery, as these will not be effective at stopping the reaction and will create a bigger mess to clean up.

## Cleanup

Sweep up sand (if used), remove any pieces of debris, and return the remaining clean sand to the quick-pour container for future use. Add more sand to the container from supplementary sand containers as needed.

Wipe down the workstation with water. Use an ESD mat cleaning solution on the affected area.

Return batteries (including any debris removed from the sand, if it was used) according to Apple Recycles and scrap procedures.

## Personal Protection

<b>Respiratory Protection</b>	Not necessary under normal conditions.
<b>Eye/Face Protection</b>	Always wear safety glasses with side shields when performing repair work involving batteries, broken glass, or any task where eye hazards could be present.
<b>Gloves</b>	Not necessary under normal conditions. Use disposable latex or nitrile gloves if handling an open or leaking battery.

## First Aid Measures

<b>Inhalation</b>	The contents of an open battery or the smoke from a thermal runaway event may cause respiratory irritation. Leave the area if necessary for comfort. Seek fresh air and medical attention if feeling unwell.
<b>Ingestion</b>	Ingestion of a lithium-ion battery is highly unlikely as the contents are mostly solid, and any free liquid (ester-based electrolyte) that might drip out of a damaged battery is limited to a few drops. However, care should be taken not to touch fingers to mouth while handling a damaged battery to avoid any ingestion of contents. Do not induce vomiting. Wash out mouth with water. Get medical attention following exposure or if feeling unwell.
<b>Skin Contact</b>	The contents of an open battery may cause skin irritation. Flush contaminated skin with plenty of water. Remove any contaminated clothing. Continue to rinse for at least 15 minutes. Get medical attention. Wash clothing before reuse.
<b>Eye Contact</b>	The contents of an open battery may cause eye irritation. Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 15 minutes. Get medical attention if irritation persists.

**Disclaimer:** The above information is provided for your information only. The information and recommendations set forth above are made in good faith and are believed to be accurate as of the date of preparation. Apple Inc. makes no warranty, either expressed or implied, with respect to this information and disclaims all liability from reliance on it.

## Broken Glass Handling

iPad, iPhone, iPod, Apple Watch displays and iPhone 4, 4s, 8, 8 Plus, and X back covers are made of glass. This glass could break if the device is dropped on a hard surface, receives a substantial impact, or is crushed, bent, or deformed. If the glass chips or cracks, do not attempt to remove the broken glass. Follow these steps:

- If the display glass is broken, put on safety glasses and cut-resistant gloves.
- Use a vacuum to remove any shards present on the work surface or the display.
- Affix a protective display cover or packing tape before removal to prevent injury or scattering of glass.
- Do not let the display cover or tape go over the edge of the display.
- For repair options, refer to the appropriate Visual/Mechanical Inspection (VMI) Guide:
  - [VMI Guide for Apple Watch](#)
  - [VMI Guide for iPad](#)
  - [VMI Guide for iPhone 4 and 4s](#)
  - [VMI Guide for iPhone 5, 5c, 5s, and SE](#)
  - [VMI Guide for iPhone 6, 6 Plus, 6s, 6s Plus, 7, 7 Plus, 8, 8 Plus](#)
  - [VMI Guide for iPhone X](#)
  - [VMI Guide for iPod touch \(5th and 6th generation\)](#)
  - [VMI Guide for iPod nano \(6th and 7th generation\)](#)
  - [VMI Guide for iPod \(all other models\)](#)

## Recent changes to this procedure:

**03 NOV 2017:** Added iPhone X. Updated Eye/Face Protection section.

**22 SEP 2017:** Added iPhone 8 and 8 Plus.

**06 APR 2017:** Added iPad, iPod, and Apple Watch. Added links to OP24 and OP685 to the Battery Handling section.

# 3D Touch Calibration Fixture Setup

This procedure should only be performed by Apple-certified technicians at authorized locations that have a 3D Touch Calibration Fixture.

The 3D Touch Calibration Fixture is intended to calibrate the 3D Touch and proximity sensor for iPhone 6s, 6s Plus, 7, 7 Plus, 8, 8 Plus, X.

Follow the instructions below to set up and validate the 3D Touch Calibration Fixture.

**Important:** This process will require two people to complete. Do not attempt it alone.



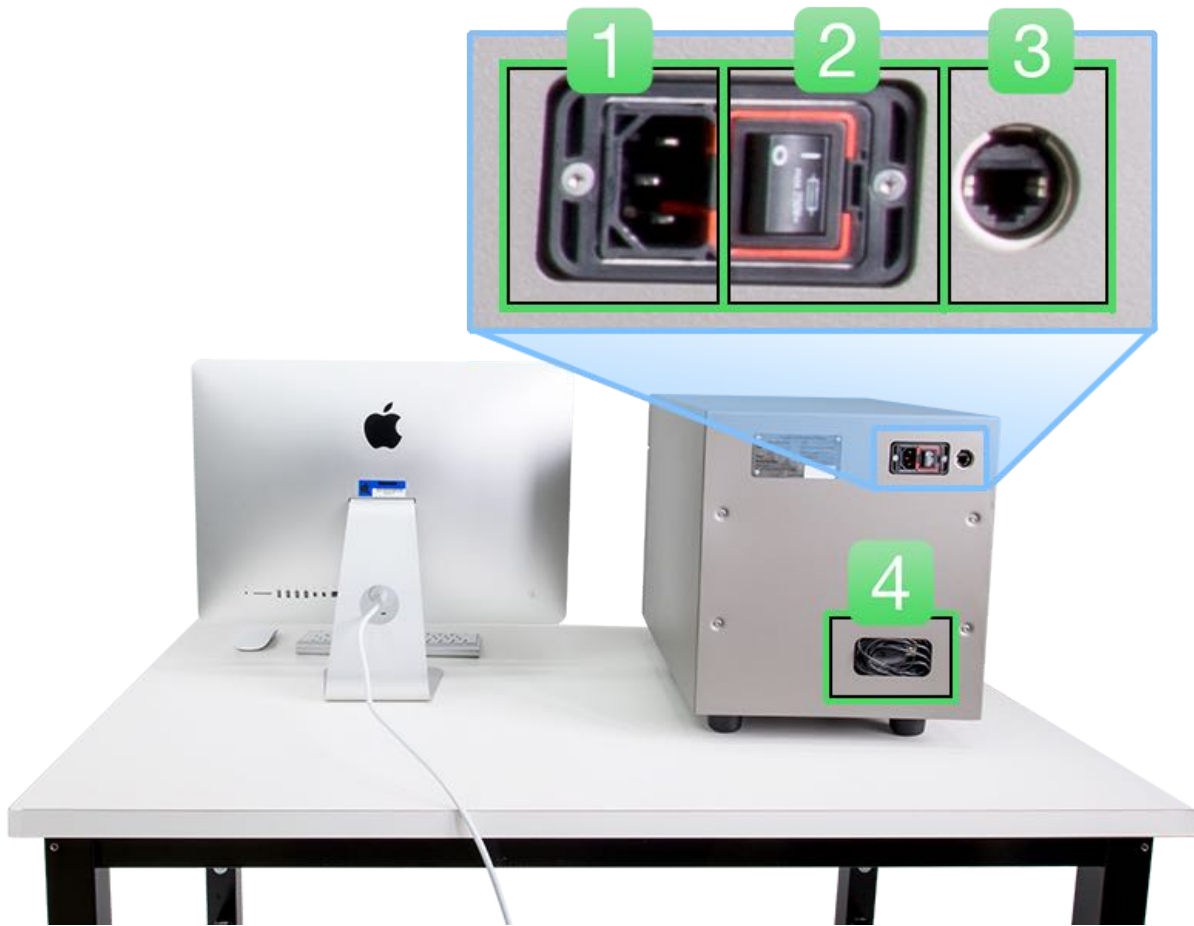
**Caution:** Do not touch any components located inside the 3D Touch Calibration Fixture. Finger oils cause test anomalies.

## Required Tools

- 3D Touch Calibration Fixture
- Accessory kit (076-00119)
  - Thunderbolt to Ethernet adapter (661-6584)
  - CAT7 Ethernet cable
  - Power cable **Note:** 50/60Hz AC required, 90–240V AC
- iMac (2014 or later)
  - 8 GB memory
  - 500 GB storage
  - 2 USB ports available for the fixture
  - Ethernet port
- Power strip
- Self-supplied Ethernet cable (for iMac internet connection)
- Self-supplied Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter
  - Note:** Use adapter with following computers only:
    - iMac (21.5-inch, 2017)
    - iMac (Retina 4K, 21.5-inch, 2017)
    - iMac (Retina 5K, 27-inch, 2017)
- Troubleshooting Unit

## Back View of 3D Touch Calibration Fixture

1. 110V/220V power socket
2. On/off switch with built-in fuse
3. Ethernet port
4. USB cable



### Fixture Setup

1. **Warning:** Moving the fixture requires two people; do not attempt to move it alone. Remove the equipment from the shipping package, ensuring that the arrow on the box is pointing up before opening. The fixture should be upright at all times. Open the box from the top and remove the fixture by lifting from the side, using the finger indents under the bottom edge of the fixture. Do not lift the fixture from the front or back. Place the fixture where all the sides are accessible.



2. Place the 3D Touch Calibration Fixture on the counter workspace, close to the iMac running the 3D TouchCal software.  
**Note:** The back of the fixture must be at least three inches (7.7 cm) away from any object or the wall. Do not position the fixture where access to the door or the buttons is obstructed. **Important:** Do not place anything on top of the fixture during operation, as this will cause a calibration failure.



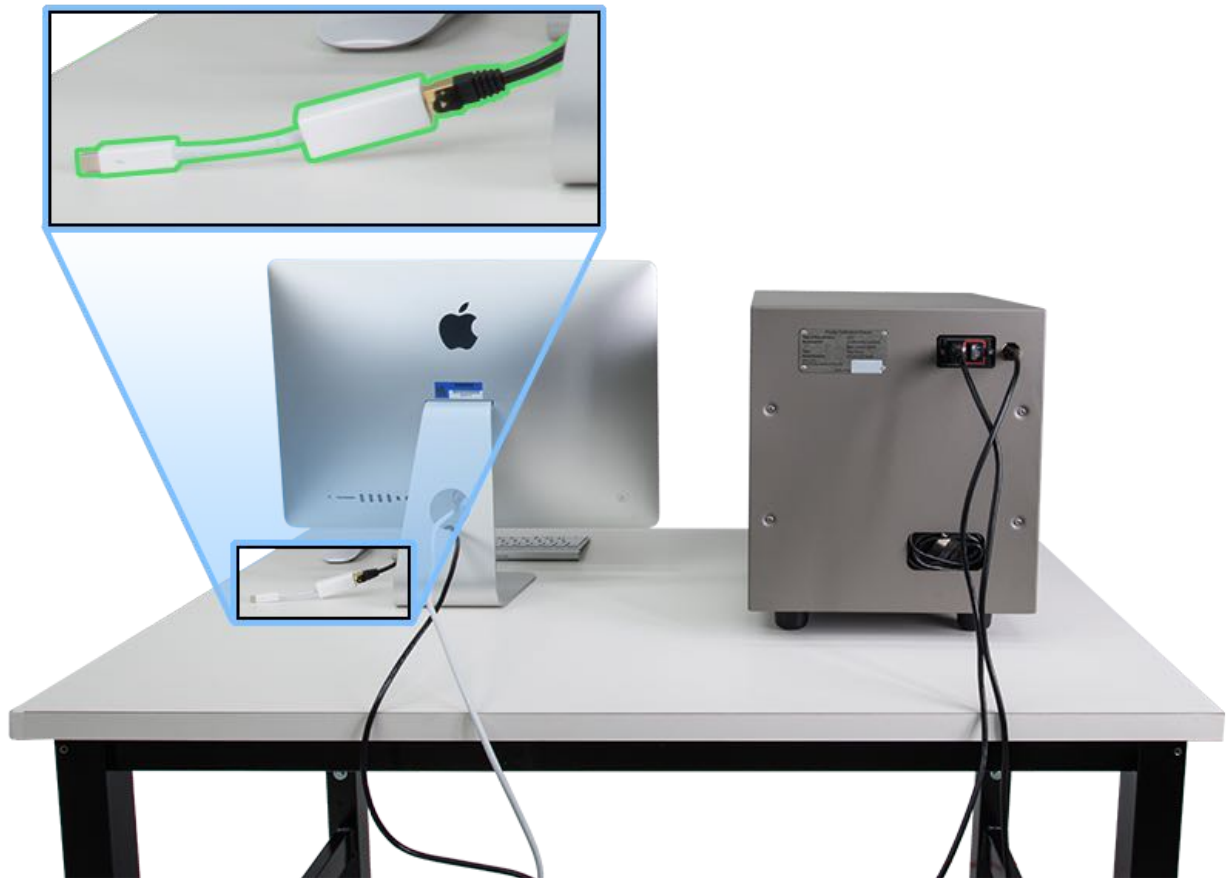
3. Identify the side of the fixture that is opposite the front door (the rear side).  
4. Open the accessory kit.  
5. Connect the power cable to the power socket on the back of the fixture.



6. Connect the Ethernet cable to the Ethernet port on the back of the fixture. **Important:** Only use the Ethernet cable included in the accessory kit.



7. If setting up with iMac (Retina 5K, 27-inch, 2017) then skip to the 2017 iMacs Setup section below.
8. Connect the Ethernet cable to the Thunderbolt to Ethernet adapter. **Important:** To function properly, the fixture must be connected to the computer with the Thunderbolt to Ethernet adapter.



9. Connect the Thunderbolt to Ethernet adapter to an available Thunderbolt port on the iMac. **Important:** The ethernet port on the iMac should be used to connect the iMac to the internet. Do not connect the fixture ethernet cable to the ethernet port on the iMac.



10. Unwrap the USB cable stored within the open cavity in the lower right corner of the back of the fixture.  
11. Connect the black USB cable from the back of the fixture to an available USB port on the iMac.





12. Plug the 3D Touch Calibration Fixture into a site-supplied power strip using the power cable from the accessory kit.
13. Turn on the fixture. **Note:** The door must be closed before turning on the fixture. The alarm light will illuminate if the door is open.
14. Refer to article [OP1788: 3D Touch Calibration Repair Station](#) for software installation instructions.



## Create a Troubleshooting Unit and Setup Verification

### Required Tools

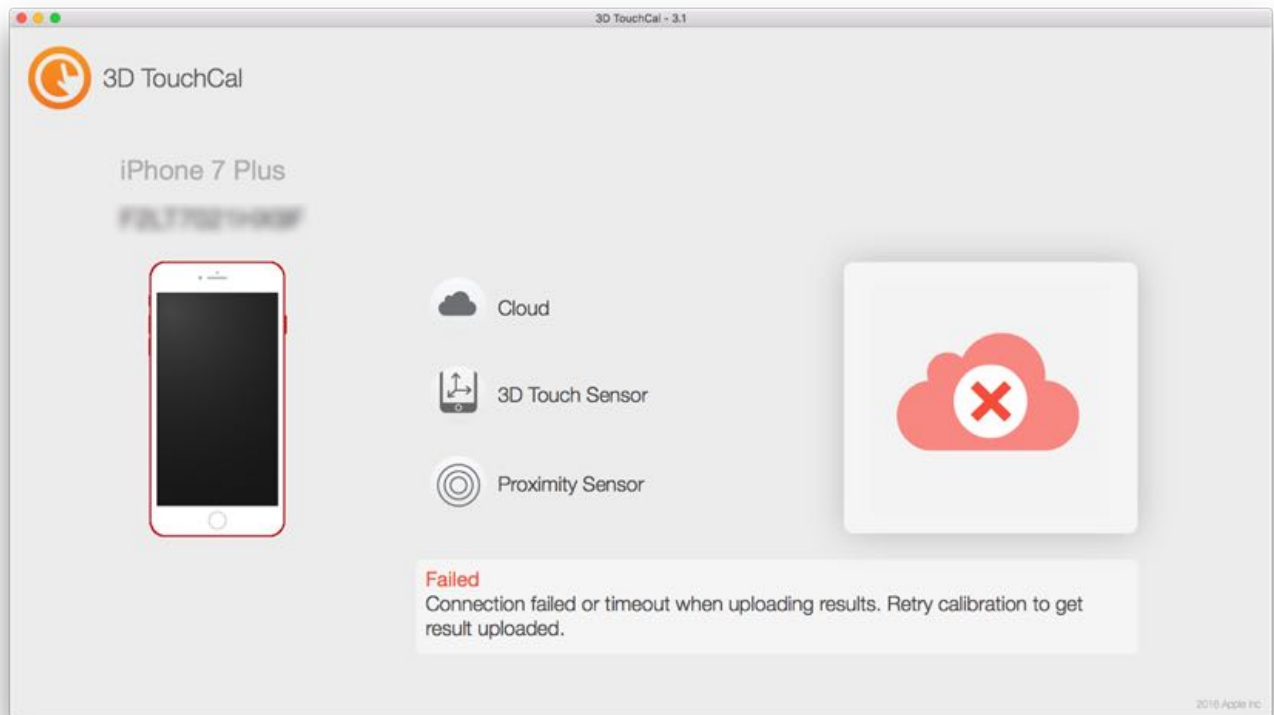
- Free-of charge whole unit iPhone
- Replacement display assembly

Use the supplied display to perform a display replacement on the supplied iPhone. Return the removed display with the flight case described below.

Refer to article [TP1548: 3D Touch Calibration Procedure](#) to calibrate a test iPhone. A GSX repair is not required to calibrate the Troubleshooting Unit.

**Important:** The calibration is expected to fail when using the Troubleshooting Unit. The error below will appear.





When the calibration fails contact ACS to confirm that the fixture setup is complete.

After ACS confirms that the calibration fixture is setup correctly and the Troubleshooting Unit is confirmed, place the Troubleshooting Unit in a secure location for future use to test fixture functionality. **Important:** Do not use The Troubleshooting Unit unless instructed to do so by ACS.

### Returning the Flight Case and KBB Display

After ACS confirms that the fixture setup is complete, submit a GSX help escalation (Display Calibration Issue) requesting the RMA for both components. ACS will provide RMA information for both the Flight case and the display removed during the creation of the Troubleshooting Unit.

**Note:** If the 3D Touch Calibration fixture arrives in a brown cardboard box, then the box does not need to be returned. To return the display removed during the creation of the Troubleshooting Unit contact ACS.

### 2017 iMacs Setup

For the following computers:

- iMac (21.5-inch, 2017)
- iMac (Retina 4K, 21.5-inch, 2017)
- iMac (Retina 5K, 27-inch, 2017)

1. Perform steps 1 through 6.
2. Connect the Ethernet (CAT7) cable from the fixture into the Gigabit Ethernet port of the iMac.
3. Connect the network Ethernet cable to the Ethernet to Thunderbolt 2 Adapter.
4. Connect the Ethernet to Thunderbolt 2 Adapter to the Thunderbolt 2 to Thunderbolt 3 (USB-C) adapter. **Note:** The Thunderbolt 2 to Thunderbolt 3 (USB-C) adapter is not included in the accessory kit. The adapter has been sourced separately by your AASP. Please contact ACS if you do not have this adapter.
5. Connect the Thunderbolt 2 to Thunderbolt 3 (USB-C) adapter to one of the Thunderbolt 3 ports on the iMac.
6. Return to step 9 above and complete the remaining steps.



### Technical and Operational Information:

Electrical: 90–240V AC, 50/60Hz, Current: 5.0A max

Dimensions:

Length: 342.9 mm (13.5 in.)  
Width: 457.2 mm (18 in.)  
Height: 391.2 mm (15.4 in.)

Nominal weight: 41.7 kg (91.2 lb.)  
 Exposure: IPX0 (not protected against water ingress)  
 Temperature: 15° C to 28° C (59° F to 82.4° F)  
 Relative humidity: 0 to 85% non-condensing  
 Altitude: -500 to 2000 m (-1640 ft. to 6562 ft.)

Label	Definition
	Hand crush hazard
	Electric shock hazard

Apple 3D Touch Calibration Fixture  
 Manufactured in Italy  
 Apple Inc.  
 1 Infinite Loop  
 Cupertino, CA 95014  
 USA

For Korea only:

**A급 기기 (업무용 정보통신기기)**  
 이 기기는 업무용으로 전자파적합등록을 한 기기이오니  
 판매자 또는 사용자는 이 점을 주의하시기 바라며, 만약  
 잘못판매 또는 구입하였을 때에는 가정용으로 교환하시기  
 바랍니다.

# Creating a Carry-In Repair for iPhone display repairs

## Topic

Use this procedure for creating a Carry-In Repair for iPhone display repairs.

**Pilot locations only:** This procedure is for locations piloting Carry-In iPhone display repairs only.

### 1. Overview

This procedure is the starting point for repairing an iPhone display. Technicians provide repairs for iPhone to help customers get their device repaired quickly, and without having to activate or restore their phone from a backup.

- Make sure the workstation and technician are properly grounded using [ESD precautions](#) (OP100).
- For an iPhone with a swollen or expanded battery, see [Safely handling lithium batteries and lithium battery-powered devices](#) (OP24) and [Embedded Battery Safety](#) (OP1761).
- For iPhone repairs with mixed failure or third party parts, see [How to process a mixed-failure repair](#) (OP1745).
- Perform Micro-Inspection when an iPhone 6 or newer model has a display replacement – see [iPhone Display Micro-Inspection Procedure](#) (TP1587).
- If the customer has a Third Party Part (TPP) display, explain that they will need to pay the out-of-warranty cost to replace the TPP component in order to resolve the functional issue. If the same-unit repair fails or is not available, the customer will be required to pay the out-of-warranty cost of the whole unit replacement. For more information, see [Servicing an Apple product that contains a third party component](#) (OP1800).
- iOS 10 or later is required to perform display repairs. Offer to help the customer upgrade if their device if they are using an iOS version earlier than iOS 10.

**Important:** Display calibration software requires the publicly released version of iOS.

In the event that same unit repair is unsuccessful, you may need to provide the customer with a whole unit replacement (WUR) after following the troubleshooting steps listed in Section 7. Before offering a component or modular repair, verify a correct model of the '661' whole unit part is available and confirm the activation details of the customer's iPhone to see if it is tied to a regional carrier or is unlocked. If replacement inventory is not available, position to the customer that if the component repair is unsuccessful, a whole unit exchange will be required. Be sure to quote your standard iPhone WUR order time to set proper expectations. A customer may opt to pay for an out of warranty device replacement.

**Protect customer information during service:** Protecting personal passwords and information is of the utmost importance. When checking a device in for service, discuss with customers the following options so they are aware of how they can protect their information.

- Before service: See [Get your iPhone, iPad, or iPod touch ready for service](#) (HT201557)
- During check-in:
  - Customers with devices running iOS 10.3 or later:
    - Perform troubleshooting with the customer present and use [Diagnostics Mode](#) (TP1570) after the device is repaired. Do not ask a customer for their iOS passcode and do not record their passcode if provided.
  - Customers with devices running iOS 10.2.1 or earlier:
    - Offer to help the customer upgrade.
    - Alternatively, customers may create a temporary passcode ([HT204060](#)) so the current passcode is not shared. When a customer chooses to set up a temporary passcode or account, be sure to remind them to reset their passcode or delete the account once service is complete.
  - Any iOS version:
    - If preferred, customers can back-up and erase their iOS device ([HT201351](#)) so their personal information is not present during repair.
  - For iPhones that are paired with an Apple Watch, see [About Activation Lock on your Apple Watch](#).
- **Note:** In the event the iPhone must be replaced (not repaired), explain to the customer their original device must be erased when they accept the replacement iPhone. This ensures the customer's information is no longer on the original device.

Customers have the option of removing their passcode lock to proceed with the repair. When the SIM PIN is enabled, all network connectivity is disabled, preventing a test call to verify the successful completion of the repair. See [iOS: Using passcodes](#) (HT4113) and [iOS: Understanding the SIM PIN](#) (HT1316) for detailed instructions.

**Note for Japan:** For devices in Japan, be sure to have the user remove any Suica card from Apple Pay before proceeding with service

**Bent enclosure** - You may attempt a display repair for an iPhone with a bent enclosure - the 'wobble test' no longer determines reparability. Do not attempt a display repair if the enclosure is bent more than what is shown in the VMI Damage Classification Guidelines.

### 2. 3D Touch Calibration Fixture Setup (Hardware)

The 3D Touch Calibration Fixture is intended to calibrate the 3D Touch and proximity sensor for iPhone 6s, 6s Plus, 7, and 7 Plus. For information about setting up the hardware, see [3D Touch Calibration Fixture Setup](#) (TP1547).

The following are best practices for using the 3D Touch Calibration Fixture:

- Periodically clean lightning cable of calibration fixture with an IPA wipe.
- Remove debris from lightning port of iPhones.
- Keep fixtures free from vibrations.
- Do not attach, lean, store, or place anything on the fixture at any time.
- When handling the display service part, hold it by the edges and peel the plastic lining of the new display down, **not away** from the metal shielding.
- Only plug the 3D Touch Calibration Fixture into the iMac.

### 3. 3D Touch Calibration Fixture Setup (Software)

For information about setting up the software, see [3D Touch Calibration Repair Station](#) (OP1788).

### 4. Creating Display Repairs in GSX

Customer must turn off Find My iPhone before the repair is created. See [Find My iPhone Activation Lock](#) (HT201365).

#### A. Running a Diagnostic and Functional Test

- Run [AST 2 for iOS](#) (TP1267) and a [Functional Test](#) (TP1045) before and after the repair to verify that the issue has been resolved and to ensure that there are no other functional failures on the unit.
- If the device's issue prevents you from running a diagnostic and/or functional test, indicate in the "Repair Notes" field why.
- Verify the reported display failure before initiating the display repair in GSX. Also, verify there is no other functional failure on the unit. If another functional failure is found follow [How to process and mixed-failure repair](#) (OP1745).

#### B. Initiating a repair in GSX

1. To begin the repair creation process, select the New Repair button at the top of the GSX homepage, or you will be prompted to create a repair after completing Integrated Troubleshooting.

**Important:** If you have multiple technicians at a site, the technician associated with the GSX repair should be the technician putting on the new display.

2. A prompt will appear asking you to select the "Customer-reported symptom and issue" at the beginning of repair creation. For example, if a customer states their device is cracked, select "Display" as the symptom and "Multiple Cracks" as the issue.

To see a list of symptoms you can perform a display replacement for, search GSX for "iPhone display replacement process".

3. Additionally, repair strategy may be determined based on answers provided for prompted questions.

4. The benefits of correctly answering questions during repair creation:

- For customers: Optimum performance from Apple products, the most accurate and streamlined repair strategy for the issue, quick turnaround time.
- For technicians: Correct compensation, fewer loopers, valuable feedback, technician insights, providing a feedback loop, data collection for future product/programs.

5. Please note that repair strategy may change during repair creation depending on data added. Based upon information entered when creating the repair, GSX may display a message that a specific repair strategy is unavailable.

### 5. Adding Display Parts to GSX

A. The relevant parts will populate based on the issue derived from the guided troubleshooting. These parts can be overridden if needed. Sometimes the correct part you need will not display. You can proceed without selecting a part from this page.

B. If additional parts are needed to complete the repair or the display part didn't populate, click the Add Part button to manually add parts. For Consumer Law Refund or Replace service types, only applicable parts will be available to be selected.

**For in-warranty and AppleCare+ devices:**

Select **No Damage** as the coverage option for non-damage related issues. Select **Returnable Damage** as the coverage option for physical damage like a cracked screen.

#### For out of warranty devices:

Select **No Damage** as the coverage option for both non-damage and physical damage like cracked screens.

Customer Parts Notes Confirm

661-07289  
DISPLAY,IPHONE 6S PLUS,SPACE GRAY,DH  
Add Part

Image Not Available

661-07289  
DISPLAY,IPHONE 6S PLUS,SPACE GRAY,DH  
Out Of Warranty (No Coverage)  
Availability: Data Not Available  
Return Status: Return Required

Coverage Options:  
No Damage

Symptom Code:  
B54-Display - Image Quality

Symptom Modifier:  
Select

Use Consignment Part: ☒

C. Any part added during the repair creation process may be removed during the order parts process.

**Note:** If you receive a “No Parts Found” error message (red banner along the top of GSX), dismiss the banner and click the Next button in the lower right corner to continue creating the repair.

D. For the **KBB Serial Number** enter the new display service part serial and delete the last digit from that number. For the **KGB Serial Number** enter the new display service part serial.

E. Click **Next**.

**Note:** To ensure the right part is selected, confirm the ring around the home button matches the color of the enclosure.

#### F. Handling DOA stock

1. If the display is DOA and a second one needs to be added, click on the “Stock DOA” button (see point 1 in red).

Carry-in Repair G28788991  
Notification 030288512395  
Repair Released from Processing / Open Repair

Status: Select...  
Assigned To: Vincent S. Lindberg - G1...

iPhone 7  
Serial # F17JMTBH07J  
IMEI: 356209078127341  
IPHONE 7, GSM, 32GB, RGLD  
Apple Limited Warranty  
Unit Received Date 08/01/17 03:00 PM

Symptom  
Reported Symptom: Physical Damage  
Reported Issue: Display - Multiple cracks

Sara  
NetIO  
SMB  
0738  
More

Billing  
Purchase Order Number 20138612/VILJ  
Reference # VILJ

Blank Note

Status 1 Parts

661-07296 SEK 755.44  
SVC,IPHONE 7  
DISPLAY,RGLD,DH  
Add Part

Image Not Available

661-07296 SEK 755.44  
SVC,IPHONE 7  
DISPLAY,RGLD,DH  
Out Of Warranty (No Coverage)  
Symptom: B92 - Physical Damage - Multiple Cracks - Damaged  
Return Status: Known Bad Board  
Status: Return Order Created  
Return Order Number: 6560760209  
Shipped On:  
Non-returnable Damage: No  
Returnable Damage: Yes  
Use Consignment Part: Yes  
KBB Serial Number:  
KGB Serial Number:  
(1) Stock DOA

2. Once the second display part is added to the repair (see point 2 in red), wait 5 minutes before updating the second display part with serial numbers or any other details (see point 3 in red). If this delay is not respected, a duplicate entry will be added to the repair (see point 3 in red).

**Carry-in Repair G283810547**  
Notification 030284430575

Closed and Completed / Closed

Assigned To: Dennis Dahlqvist - Q1F9

**iPhone 7**  
Serial # F4G5T10SHG7J  
IMEI: 35330081476782  
iPhone 7,03M,32GB,RGLD  
Apple Limited Warranty

Unit Received Date 06/27/17 09:05 AM

**Symptom**  
Reported Symptom: Display  
Reported Issue: Blank Black Screen - Power On

**Anni**  
Ringu  
louise  
07077  
More...

**Billing**  
Purchase Order Number 20130201/DEDA  
Reference # DEDA

**Parts and Pricing**  
661-07296 SEK 0.00  
661-07296 SEK 0.00  
More...

**Sold To Account**  
0001

**Ship**  
MCA

Status 2 Parts

661-07296 SEK 0.00 SVC.IPHONE 7 DISPLAY,RGLD,DH	Image Not Available	661-07296 SEK 0.00 SVC.IPHONE 7 DISPLAY,RGLD,DH
661-07296 SEK 0.00 SVC.IPHONE 7 DISPLAY,RGLD,DH		<p>Symptom: B64 - Sound - Microphone - Continuous</p> <p>Return Status: Known Bad Board</p> <p>Status: Return Order Received</p> <p>Return Order Number: 6558462187</p> <p>Return Tracking Number: 1Z4W63V68696776834</p> <p>Shipped On: 06/28/17</p> <p>Non-returnable Damage: No</p> <p>Returnable Damage: No</p> <p>Use Consignment Part: Yes</p> <p>KBB Serial Number: FVQ7084C8FMH1NHAA</p> <p>KGB Serial Number: FVQ7084G2B3H1NHAC</p>

Total Tax SEK 0.00  
Total Amount SEK 0.00

**Carry-in Repair G286388843**  
Notification 030287010215

Repair Marked Complete / Closed

Assigned To: Mattias Sparring - Q1F9

**iPhone 7**  
Serial # F17SLK  
IMEI: 353805085054267  
iPhone 7,03M,32GB,RGLD  
Apple Limited Warranty

Unit Received Date 07/20/17 05:00 AM

**Symptom**  
Reported Symptom: Physical Damage  
Reported Issue: Display - Multiple cracks

**lor**  
Eig  
071  
More...

**Billing**  
Purchase Order Number 20134625/MASP  
Reference # MASP

**Escalation 6835**  
Click Help  
OPEN - Apple

**Parts and Pricing**  
661-07296 SEK 755.44  
661-07296 SEK 0.00  
661-07296 SEK 0.00  
More...

**Sold To Account**  
00010117

**Ship-To (0001011)**  
MCJ  
HAA  
STO  
See

Status 3 Parts

661-07296 SEK 755.44 SVC.IPHONE 7 DISPLAY,RGLD,DH	Image Not Available	661-07296 SEK 755.44 SVC.IPHONE 7 DISPLAY,RGLD,DH
661-07296 SEK 0.00 SVC.IPHONE 7 DISPLAY,RGLD,DH		<p>Symptom: B92 - Physical Damage - Multiple Cracks - Damaged</p> <p>Return Status: Dead On Arrival</p> <p>Status: Outbound Order Shipped</p> <p>Return Order Number: 6559930177</p> <p>Return Tracking Number: 1Z4W63V686965232066</p> <p>Shipped On: 07/20/17</p> <p>Non-returnable Damage: No</p> <p>Returnable Damage: Yes</p> <p>Use Consignment Part: Yes</p> <p>KBB Serial Number: FVQ7077C4S8H1NHAA</p> <p>KGB Serial Number:</p>
661-07296 SEK 0.00 SVC.IPHONE 7 DISPLAY,RGLD,DH		

Total Tax SEK 188.86  
Total Amount SEK 944.30

Nothing on the repair will confirm that you can go ahead and update the second part details. This does not stop you from creating multiple repairs (but needs to be mindful of the 5 mins time lag).

## 6. Repairing and Calibrating iPhone Displays

### A. Repairing the device

#### 1. iPhone 6s

- [Open Device](#) (RP1264)
- [iPhone 6s Open Device Video](#) (SV284)
- [Replace Display Assembly](#) (RP1266)

#### 2. iPhone 6s Plus

- [Open Device](#) (RP1258)
- [iPhone 6s Plus Open Device Video](#) (SV285)
- [Replace Display Assembly](#) (RP1260)

#### 3. iPhone 7

- [Open Device](#) (RP1326)
- [iPhone 7 Open Device Video](#) (SV311)
- [Replace Display Assembly](#) (RP1332)

#### 4. iPhone 7 Plus

- [Open Device](#) (RP1333)
- [iPhone 7 Plus Open Device Video](#) (SV317)
- [Replace Display Assembly](#) (RP1339)

**B. Calibrating Device** - After installing the service part display on the customer's iPhone, the next step is to calibrate the device. You must calibrate the new display to the iPhone's main logic board. If the display calibration fails, see [Section 7](#), Troubleshooting Failures.

**Important:** It is required for the technician to have the repair open in GSX and add a display part to the repair before calibration. Not having the repair open with a display part will cause a failure in the calibration process. For more information about adding a display part, see [Section 5](#).

## 7. Troubleshooting Failures

During the course of a repair there may be issues with the repair, which result in a change of the original repair quote. This may require a whole unit replacement. Before every iPhone repair, it is important to set proper expectations with the customer of the possibility of a requote. Include in the notes what the customer has approved to repair.

Examine an iPhone for additional issues by running diagnostics and performing a functional test. Diagnostics and a functional test should be completed before and after the repair to verify that the issue has been resolved.

If you are unable to complete the modular repair, you must answer the question in the Troubleshooting section of the repair record. Select the most accurate reason preventing you from completing the repair.

**A. Visible failures before calibration** - After installing the replacement display, if you see issues with the display (e.g., lines in the display) then take the follow steps before calibrating the iPhone:

1. Reseat the display cables
2. If the issue is still not resolved, attempt a second display. If the second display has no visible issues, mark the first display used as DOA. A new display service part should be added to the repair. For the new display service part part, use the same compTIA as the first display part and continue the repair. For more information, see [section 5.F](#).
3. If the second display also has visible issues, the iPhone is unrepairable. Remove the second display and return it to inventory. Place the first display attempted on the iPhone and mark the repair complete.

See section C, [Display fails a third calibration attempt](#), for instructions on creating a second repair.

**B. Fails the initial calibration** - If the initial calibration fails, try these best practices using the display part:

**Note:** A maximum of two displays should be used for calibration. There is only one exception when you should use a third KGB display on a repair. If a second display was used because of visible failures before calibration, a third display may be used if the 3D Touch Calibration software prompts you to try another display.

### C. Display fails a third calibration attempt

**1. In Warranty or AppleCare+ display failure** - If a display calibration fails and there is no additional damage preventing the ability to perform the repair, mark the display repair complete in GSX. Create a second repair and replace the device in-warranty. Classify the issue as **Calibration Unsuccessful**.

Note: The customer is responsible for any charges on the first repair unless third party modification is found. See Section 7.C.3, **Third Party Modification**.

**2. Out of Warranty Display Failure** - When an iPhone is out of warranty, and the display calibration fails with no additional damage preventing the ability to perform the repair, then you will be able to offer the customer a whole unit replacement for the price of a display repair.

- a) Complete the display repair in GSX
- b) Transact the original repair for the cost of the display.
- c) Create a second repair for a whole unit replacement.
- d) Select **Display** as the Reported Symptom and **Calibration Unsuccessful** as the Reported Issue.
- e) Select **No Damage** as the coverage option. Do not charge the customer and transact the repair for the whole unit replacement.



f) ACS will provide a credit for the whole unit replacement. No escalation is needed.

### 3. Third party modifications

a) Complete the display repair in GSX

b) Do not charge the customer and transact the display repair.

c) ACS will provide a credit for the display repair. No escalation is needed.

d) Create a second repair for a whole unit replacement. Select **Display** as the Reported Symptom and **Calibration Unsuccessful** as the Reported Issue.

e) If the device is In Warranty by time - mark **Returnable Damage** as the Coverage Option. If the device is Out of Warranty by time - mark **No Damage** as the Coverage Option.

f) Charge the customer for a whole unit replacement.

**D. Multiple Issues Found** - You may discover multiple failures as a result of diagnostics during the creation of a repair or before you've started the repair. In this situation, select the issue that has the greater impact on the iPhone functionality when classifying the repair. Reference [How to process a mixed-failure repair](#) (OP1745) for more information.

You may also discover another failure through post-repair diagnostics or after completing calibration. For these situations, you can list more than one component part in the repair quote if the failure can be resolved with an additional same unit repair (SUR).

If the additional failure requires a whole unit replacement, follow the steps below:

a) Complete the display repair in GSX.

b) Transact the original repair for the cost of the display.

c) Create a second repair for a whole unit replacement.

d) Select Display as the Reported Symptom and Calibration Unsuccessful as the Reported Issue. From the drop down select Multiple Failures Found.

e) Select No Damage as the coverage option. Do not charge the customer and transact the repair for the whole unit replacement.

f) ACS will provide a credit for the whole unit replacement. No escalation is needed.

**Changing coverage** - Physical damage is not covered by warranty and any parts affected by that damage must be quoted as out of warranty. This requires the technician to carefully classify the repair and even change coverage for the parts quoted. For example, the customer reports the speaker is not functioning for an iPhone that is under warranty. The iPhone has a damaged screen which must be replaced to perform the speaker repair. In this case, the display should be quoted out of warranty, and the speaker assembly will be covered by the iPhone's limited warranty.

**Note:** Service providers will be billed for incorrect warranty classifications of customer displays.

**Swap Repair becomes necessary** - When the reported issue can be serviced by a modular repair but additional damage prevents access to replace that component, explain this to the customer. If the additional damage prevents completion of a modular repair you must quote a whole unit replacement (e.g. multiple cracks to the display and a dented enclosure prevents access to successfully replace the Vibe Motor).

**E. Fixture Downtime** - If the 3D Touch Calibration Fixture is experiencing downtime, you will be able to offer the customer a whole unit replacement for the price of a display repair. Follow the steps below for this process in GSX:

- Make sure you and the workstation are properly grounded using [ESD precautions](#) (OP100).
- Read the [3D Touch Calibration Procedure](#) (TP1548) to make sure the fixture is working properly and that you are following the most current instructions for performing the calibration.
- Follow the instructions of the calibration software. **Note:** If calibration fails, the phone may be in recovery mode. This is expected. You can attempt calibration again with the phone in recovery mode.
- Display calibration software may prompt the technician to use a second KGB display.  
**Note:** Make sure to DOA the first display used and add the new display service part. For the new display service part, use the same compTIA as the first display service part.
- Reseat display cables and hard-reset the device. Attempt to calibrate the device again.



1. Complete the display repair in GSX.
2. Transact the original repair for the cost of the display.
3. Create a second repair for a whole unit replacement.
4. Select **Display** as the Reported Symptom and **Calibration Unsuccessful** as the Reported Issue. From the drop-down menu, select **Multiple Failures Found**.
5. Select **No Damage** as the coverage option. Do not charge the customer and transact the repair for the whole unit replacement.
6. ACS will provide a credit for the whole unit replacement. No escalation is necessary.
7. Create and complete the display repair in GSX.

**Note:** You will still need perform the physical display repair for this process, but it does not need to be calibrated.

8. Transact the original repair for the cost of the display.
9. Create a second repair for a whole unit replacement.
10. Select **Display** as the Reported Symptom and **Calibration Unsuccessful** as the Reported Issue. From the drop-down menu, select **Calibration Fixture Down**.
11. Select **No Damage** as the coverage option. Do not charge the customer and transact the repair for the whole unit replacement.
12. ACS will provide a credit for the whole unit replacement. No escalation is needed.

## 8. Verify Repair and Functional Test

Verify the repair resolved the reported issue and perform [Functional Test](#) (TP1045). If it did not resolve the issue, see [Section 7](#).

## 9. Handling Parts

- Make sure to keep all the packaging from the display service part. This is needed to repackage the customers old display.
- If multiple displays were used make sure to have the correct display serial number added to the case.
- DOA Parts - When the replacement part is damaged by technician attempting the repair service, or they determine it was defective (DOA), we need to account for that action. See [How to Process DOA Stock Parts](#) (OP22).

## 10. Returning the product to the customer after the repair

- Make sure to clean the device before returning it to the customer. See [Cleaning procedures](#) (TP320).
- Sign - Have the customer sign for the service and close the repair.

## 11. AppleCare+ and AppleCare Protection Plan Considerations

Replacing a damaged display is an out of warranty repair. The exception is when an iPhone is covered by AppleCare+ for iPhone. To learn where AppleCare+ is sold and where service is available, see [Selling AppleCare+ agreements in GSX](#) (OP659)

**A. AppleCare+ Incident** - When the customer has AppleCare+ for iPhone, the display repair can be covered as an incident. To learn what is eligible for covered under an incident, see [AppleCare+ for iPhone's terms and conditions](#).

**B. AppleCare Protection Plan for iPhone** - A damaged display is considered accidental damage which is not covered under the terms of the AppleCare Protection Plan for iPhone.

**C. Consumed Battery** - Batteries may be replaced at no charge for iPhones covered by an AppleCare+ or AppleCare Protection Plan when the diagnostic results indicate a defective or consumed battery.

The customer can choose a same unit repair or a whole unit repair when consuming an AppleCare+ incident. Be careful to choose the appropriate part with the correct fee (display repair part for a display replacement or non-repairable part for a whole unit replacement).

## 12. iPhone display repair training

Training for iPhone display repairs is available on ATLAS.

[ATLAS - Phone Display Replacement and 3D Touch Calibration](#)

## 13. Support from ACS

For issues with the calibration equipment, follow the steps in [Troubleshooting the 3D Touch Calibration Fixture](#) (TP1571).

ACS English Chat support is available 24 hours a day, 5 days per week (Monday through Friday) for questions about the display repair process, the calibration equipment, tools, or inventory. Other languages availability varies. Weekend ACS Chat support is available for calibration fixture issues.

Support for issues with the calibration fixture will be available 24 hours a day, 7 days per week in English and Chinese.

**Note:** To ensure you get to the right team for support, reference [Best practices to follow when escalating to AppleCare Channel Support](#) (OP1401).

Please ensure the following are performed before initiating a chat support to ACS:

- Create a GSX Escalations (OP580 : Creating and managing escalations in GSX)
- Choose the correct Issue Category
- Provide the following details in the escalation notes:
- Fixture Serial Number (location of serial number shown in the image below)



- Error Message
- Issue observed
- Images of failure
- Images of Network settings
- Initiate a chat support with GSX Case ID, see [Best practices/Selecting correct issue category for ACS Chat](#) (OP1514)

**Note:** If you are having trouble with the calibration machine and/or iMac, it is best to use a separate computer for contacting ACS.

**Important:** For the best customer experience do not send the customer to the Apple retail store.

#### 14. Returning KBB 3D Touch Calibration Fixture

For information about how to pack the KBB Fixture, see [Instructions for packing Display Calibration Fixtures for return](#) (OP1830).

# 3D Touch Calibration Repair Station

## Topic

Follow this procedure when imaging the Mac used with the 3D Touch Calibration fixture.

**Pilot locations only:** This procedure is for locations piloting Carry-In iPhone display repairs only.

### 1. Overview

The 3D Touch Calibration Fixture is intended to calibrate the 3D Touch and proximity sensor for iPhone 6s, 6s Plus, 7, 7 Plus, 8, 8 Plus, and X.

Follow the instructions below to set up and validate the 3D Touch Calibration Fixture.

### 2. Installing the 3D Touch Calibration software on a New Fixture Station

A. Setup a Mac (2014 or later) with a clean installation of macOS (10.12.4 or later).

B. Create an administrator user account with a password.

C. Download the following installation packages on the desktop of the fixture station Mac.

- 1) [MatlabRuntime](#)
- 2) [3D Touch Calibration](#)
- 3) [3D Touch Calibration Support Software](#)

D. Install the packages on the clean macOS (10.12.4 or later) fixture station. When prompted, enter the administrator username and password. **The packages must be installed in the following order:**

- 1) 1\_MatlabRuntime (**Right click, choose Open**)
- 2) 2\_3DTouchCal
- 3) 3\_3DTouchCal\_SupportSoftware

#### Notes:

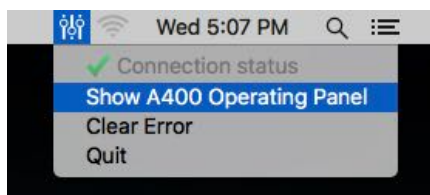
- 3D TouchCal can only run on macOS (10.12.4 or later)
- The installation order is significant and must be followed.

E. Verify the calibration fixture is correctly connected to the fixture station computer and that the calibration fixture is powered on. See [3D Touch Calibration Fixture Setup](#) (TP1547).

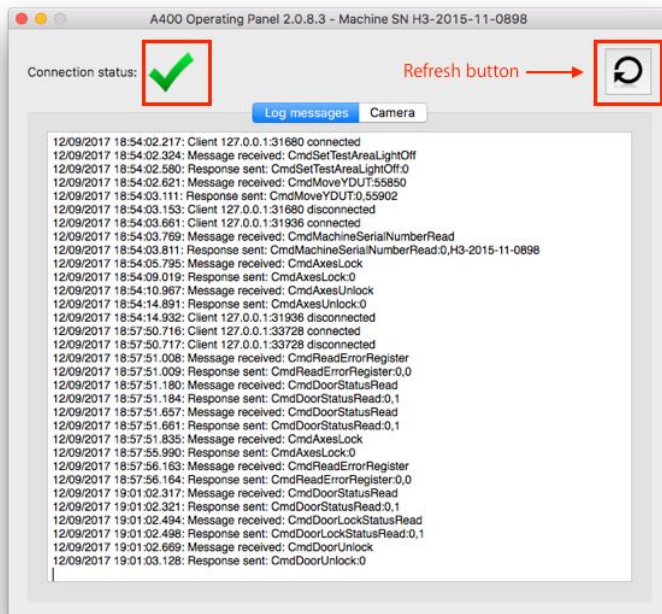
F. Restart the computer.

G. Log in to the administrator user.

H. After 30 Seconds, the A400 Panel should launch and show on Menu bar. Open A400 Panel by clicking its icon on menu bar and choosing "Show A400 Operating Panel"



I. Look for green check mark in the Operating Panel window. If you do not see it, click the refresh button in the operating panel. It could take up to 15 minutes for the green check mark to appear. Do not restart the computer or fixture while waiting for the green check mark.



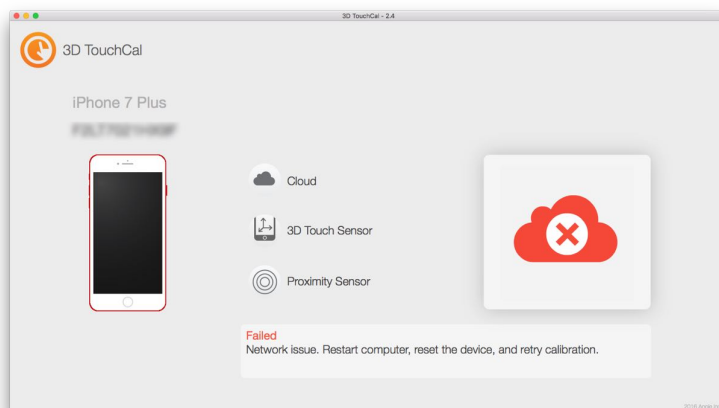
J. Launch the 3D TouchCal.app from the Applications folder.

### 3. Verification

**A. Test calibration on the fixture** - Run your Troubleshooting Unit on the new 3D TouchCal fixture station to validate installation was successful. If your location does not have a Troubleshooting Unit, contact ACS.

**Note:** Do not replace the display of the Troubleshooting Unit. The display does not need to be replaced to test the 3D TouchCal fixture station.

**Important:** The calibration is expected to fail when using the Troubleshooting Unit. The error in the image below will appear.



**B. Contact ACS to confirm fixture station** - When the calibration fails, contact ACS to confirm that the fixture station is verified for use for display replacements.

### 4. Upgrade or Reinstall Software on a Fixture Station

In situations where a fixture station has previously been set up and you are required to upgrade or reinstall the package, the required software packages can be found in GSX article OP1788. Please note that only two of the three packages are required for an upgrade.

- A. Log in as an administrator on the fixture station.
- B. Verify the 3DTouchCal application is not running.

C. Download the following installation packages and place them on the desktop of the fixture station Mac.

- 1) [3D Touch Calibration](#)
- 2) [3D Touch Calibration Support Software](#)

D. Do not uninstall current software.

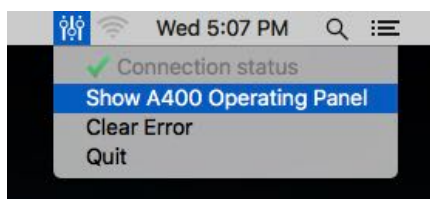
E. Install the packages on the fixture station. When prompted, enter the administrator username and password.  
**The packages must be installed in the following order:**

- 1) 2\_3DTouchCal
- 2) 3\_3DTouchCal\_SupportSoftware

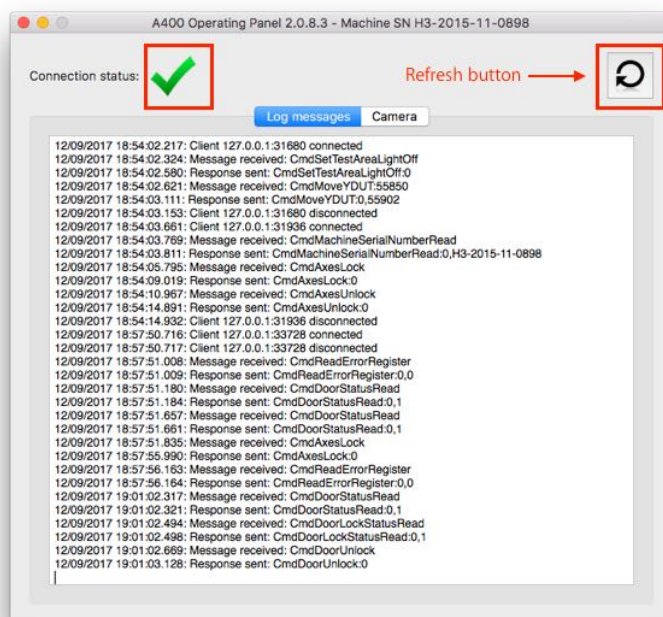
E. Restart the fixture station computer.

F. Log in to the fixture station computer.

G. After 30 Seconds, the A400 Panel should launch and show on Menu bar. Open A400 Panel by clicking its icon on menu bar and choosing "Show A400 Operating Panel"



H. Look for green check mark in the Operating Panel window. If you do not see it, click the refresh button in the operating panel. It could take up to 15 minutes for the green check mark to appear. Do not restart the computer or fixture while waiting for the green check mark.



I. Launch 3D TouchCal.app from Application folder.

## Other Resources

[3D Touch Calibration Fixture Setup](#) (TP1547)


[3D Touch Calibration Procedure](#) (TP1548)

[Display Replacement and 3D Touch Calibration Video](#) (SV345)


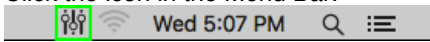
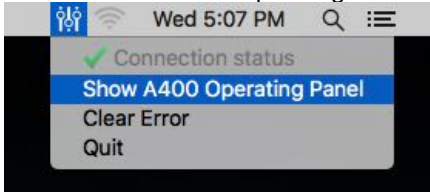
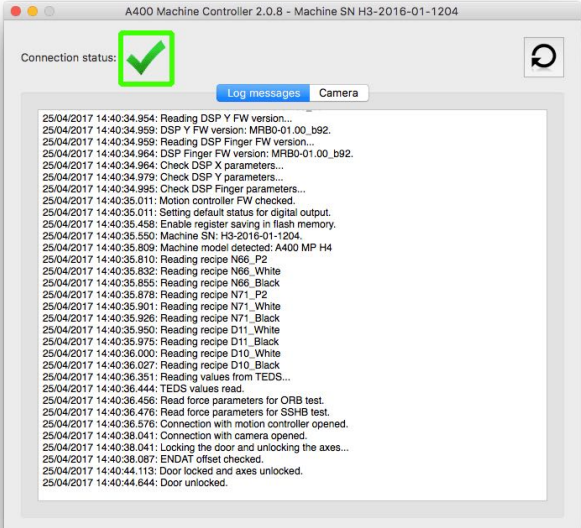
Chat with [ACS](#) for any questions regarding the 3D Touch Calibration fixture and software image.

## Troubleshooting the 3D Touch Calibration Fixture

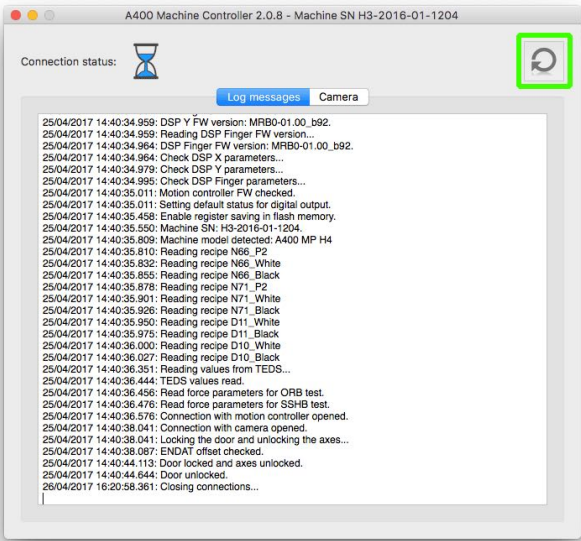
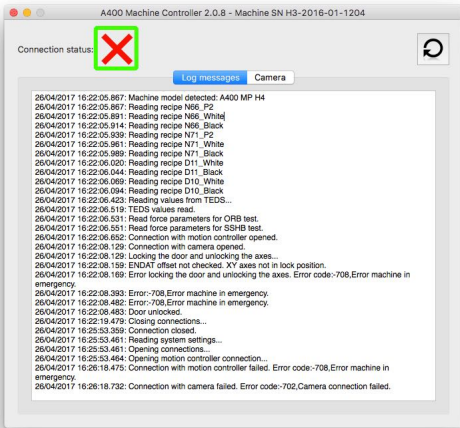
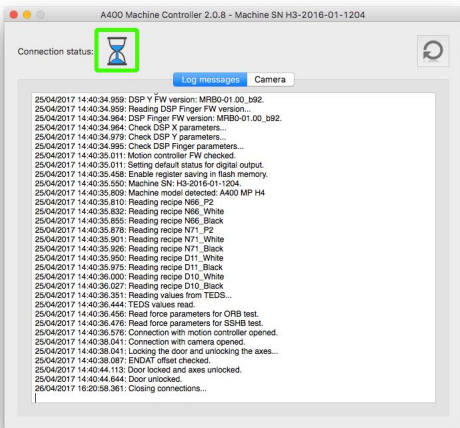
Symptoms	Quick Checks
<ul style="list-style-type: none"> <li>3D Touch Calibration Fixture will not turn on</li> <li>3D TouchCal software will not run</li> <li>3D Touch Calibration Fixture calibration fails repeatedly</li> <li>3D Touch Calibration Fixture door will not open</li> <li>3D TouchCal software crashes</li> </ul>	<ul style="list-style-type: none"> <li>Requirements include a Mac mini (2014 or later), 8GB memory, 500GB storage, and an active Internet connection.</li> <li>Do not connect any other devices into the Mac mini used for calibration.</li> <li>Ensure the 3D Touch Calibration Fixture door is fully closed when attempting calibration.</li> <li>Try to turn the 3D Touch Calibration Fixture off then turn the fixture back on. Ensure all cables (power, USB, CAT7, Thunderbolt to Ethernet adapter) are plugged in properly. Reseat the USB to Lightning device under test (DUT) cable to iPhone. Restart the 3D TouchCal software.</li> <li>Turn off and restart the Mac mini at the 3D Touch Calibration Fixture station.</li> <li>Ensure the Mac mini date and time are correct in System Preferences.</li> <li>While calibrating, avoid causing vibrations and movement of the fixture.</li> </ul>

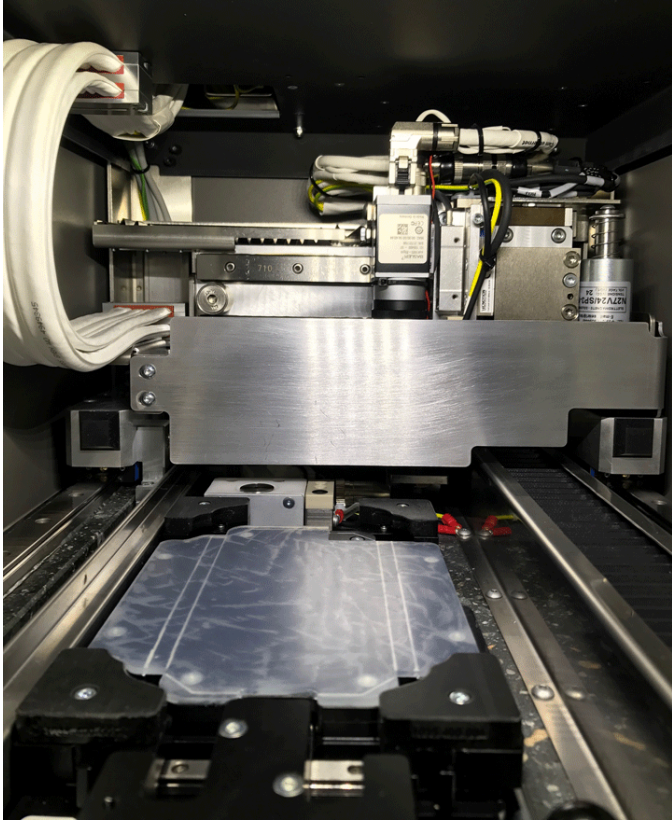
	Check	Result	Action
1	Refer to article <a href="#">TP1547: 3D Touch Calibration Fixture Setup</a> . Ensure all instructions were followed correctly.	Yes	Go to step 5.
	Does the Fixture turn on? Is the LED on? 	No	Go to step 2.
2	Try using a different power cord and power outlet. Turn on the fixture.	Yes	Go to step 3.
	Does the light on the front of the fixture flash red?	No	Create a GSX Escalation, then contact ACS. Refer to article <a href="#">OP580: Creating and managing escalations in GSX</a> .
3	Does the light on the front of the fixture flash red after 30 seconds then illuminate solid green?	Yes	Go to step 9.
		No	Go to step 4.

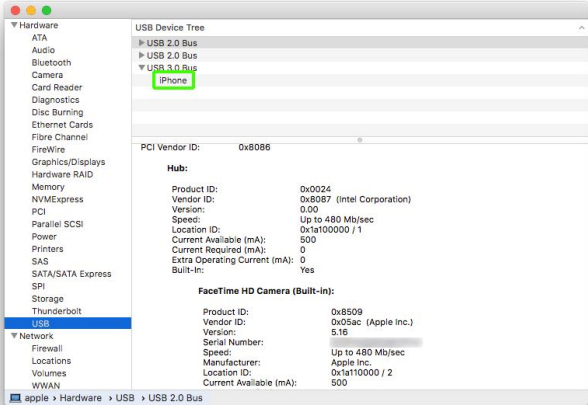
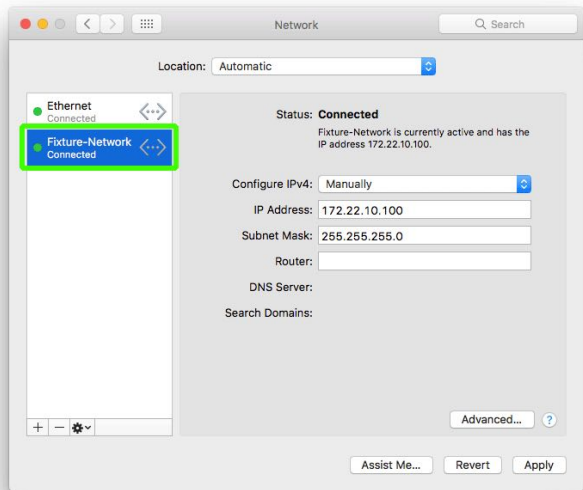


4	<p>Check if EMO button is triggered by rotating clockwise.</p> <p>Did EMO button rotate?</p> <ul style="list-style-type: none"> <li>• If EMO button rotates, button was triggered.</li> <li>• If button does not rotate, EMO button was not triggered.</li> </ul>	<p>Yes</p>	<p>Press and hold silver reset button on front of fixture for one second then release. Wait 30 seconds, then go to step 5.</p> 
5	<p>Click the icon in the Menu Bar.</p>  <p>Choose "Show A400 Operating Panel."</p>  <p>Does the Connection Status have a Green checkmark?</p> 	<p>Yes</p> <p>No</p>	<p>Restart fixture by toggling the on/off switch in the rear of fixture to "off" and back to "on." If LED is illuminated green, then go to step 5. If issue persists, create a GSX Escalation then contact ACS.</p> <p>Attempt calibration with Troubleshooting Unit. Go to step 17.</p> <p>Go to step 6.</p>



6	<p>Cycle the connection status by pressing the Refresh button on the top right corner of the A400 Operating Panel.</p> <p>Does the Connection Status have a green checkmark after 1 minute? (The hourglass may appear for about a minute.)</p> 	<p>Yes</p> <p>No</p>	<p>Attempt calibration with Troubleshooting Unit. Go to step 17.</p> <p>If A400 Operating Panel shows a Red “X” or hourglass for longer than 2 minutes, go to step 7.</p>  
7	<p>Press and hold the silver reset button for one second then release.</p> <p>Does the light on the front of the fixture illuminate solid Green?</p>	<p>Yes</p> <p>No</p>	<p>Go to step 8.</p> <p>Create a GSX Escalation, then contact ACS.</p>

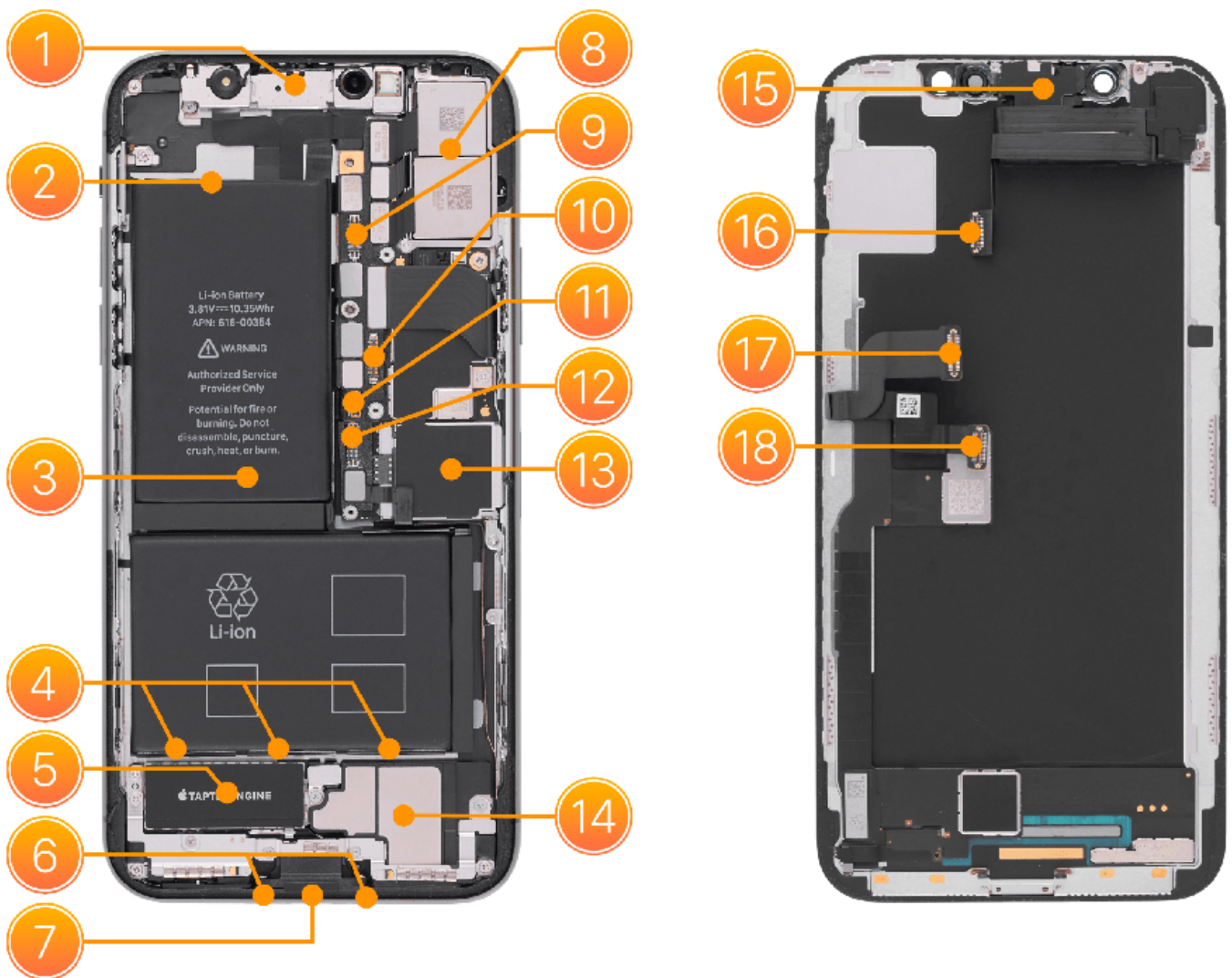
8	<p>Observe the testing armature inside the fixture. The armature should be in the default shipping position (all the way back and to the right, locked in place).</p> <p>Is the testing armature all the way back in the locked position? If you are unsure create a GSX Escalation, then contact ACS.</p> 	Yes	Go to step 9.
		No	Create a GSX Escalation, then contact ACS.
9	<p>Ensure the Ethernet cable (CAT7) and a known-good Thunderbolt to Ethernet adapter are properly connected to the Mac Mini.</p> <p>Do you have the correct cable and adapter?</p>	Yes	Go to step 10.
		No	Create a GSX Escalation, then contact ACS.
10	<p>Check the USB connections on the back of the Mac Mini.</p> <p>Are there any other fixtures plugged into the Mac Mini?</p>	Yes	Unplug all other fixtures connected to the Mac Mini. Go to step 11.
		No	Go to step 11.
11	<p>Check the connection of the Thunderbolt to Ethernet adapter to the Mac Mini.</p> <p>Is the adapter plugged into a Thunderbolt port?</p>	Yes	Go to Step 12.
		No	<p>Ensure the Mac Mini has a working Thunderbolt port. Do not use a Mini DisplayPort or USB to Ethernet adapter.</p> <ul style="list-style-type: none"> <li>• If so, plug in fixture and go to step 12.</li> <li>• If not, see fixture Mac Mini requirements in Quick Checks.</li> </ul>

12	Quit the 3D TouchCal software. Insert Troubleshooting Unit inside fixture. Check the USB connection to the Mac Mini after closing fixture door by going to About This Mac > System Report > Hardware > USB.	Yes	Launch the 3D TouchCal software. Go to step 13.
	<p>Is "iPhone" listed as a connected device in the fixture listed under USB in System Information?</p> 	No	Double check the USB connection between the fixture and the Mac Mini. If issue persists, create a GSX Escalation then contact ACS.
13	Go to System Preferences > Network.	Yes	Go to step 14.
	<p>Is the Fixture Network listed?</p> 	No	Restart the Mac Mini. If Fixture Network still does not show, re-install 3D Calibration Software Package on the Mac Mini. Refer to article <a href="#">OP1788: 3D Touch Calibration Repair Station</a> . If issue persists, create a GSX Escalation then contact ACS.
14	Go to System Preferences > Network. Check that the Fixture Network interface is active.	Yes	Go to step 15.
	Is there a green status indicator next to Fixture Network?	No	Verify fixture is turned on. If issue persists, create a GSX Escalation then contact ACS.
15	Go to System Preferences > Network. Check that only the Fixture Network is set up.	Yes	Unplug the Thunderbolt to Ethernet adapter and reinstall 3D Calibration Software Package on the Mac Mini. Then plug in Thunderbolt to Ethernet adapter and restart the Mac Mini. If issue persists, create a GSX Escalation then contact ACS.
	Is there an additional Thunderbolt to Ethernet network interface listed with a green status indicator?		Go to step 16.

16	<p>The 3D TouchCal software requires an active Internet connection. Open Safari and navigate to apple.com.</p> <p>Are you able to open apple.com?</p>	Yes	Attempt calibration with Troubleshooting Unit. Go to step 17.
		No	Contact System Administrator to troubleshoot the Internet connection.
17	Did the attempt at calibration of the Troubleshooting Unit pass?	Yes	The 3D TouchCal fixture is working normally.
		No	Go to step 18.
18	Contact ACS to check Calibration Network System Status and next steps.		Contact ACS to check Calibration Network System Status and next steps.

# Internal View, Parts List, Screw Diagram

## Internal View of iPhone X



1. TrueDepth camera assembly
2. Battery adhesive tab
3. Battery
4. Battery adhesive tabs
5. Taptic Engine
6. Bottom microphones
7. Lightning connector
8. Cameras
9. Receiver/ALS/proximity connector
10. Display connector
11. Battery connector
12. 3D Touch / Multi-Touch connector
13. SIM reader
14. Speaker
15. Receiver
16. Receiver/ALS/proximity flex
17. Display flex
18. 3D Touch / Multi-Touch flex

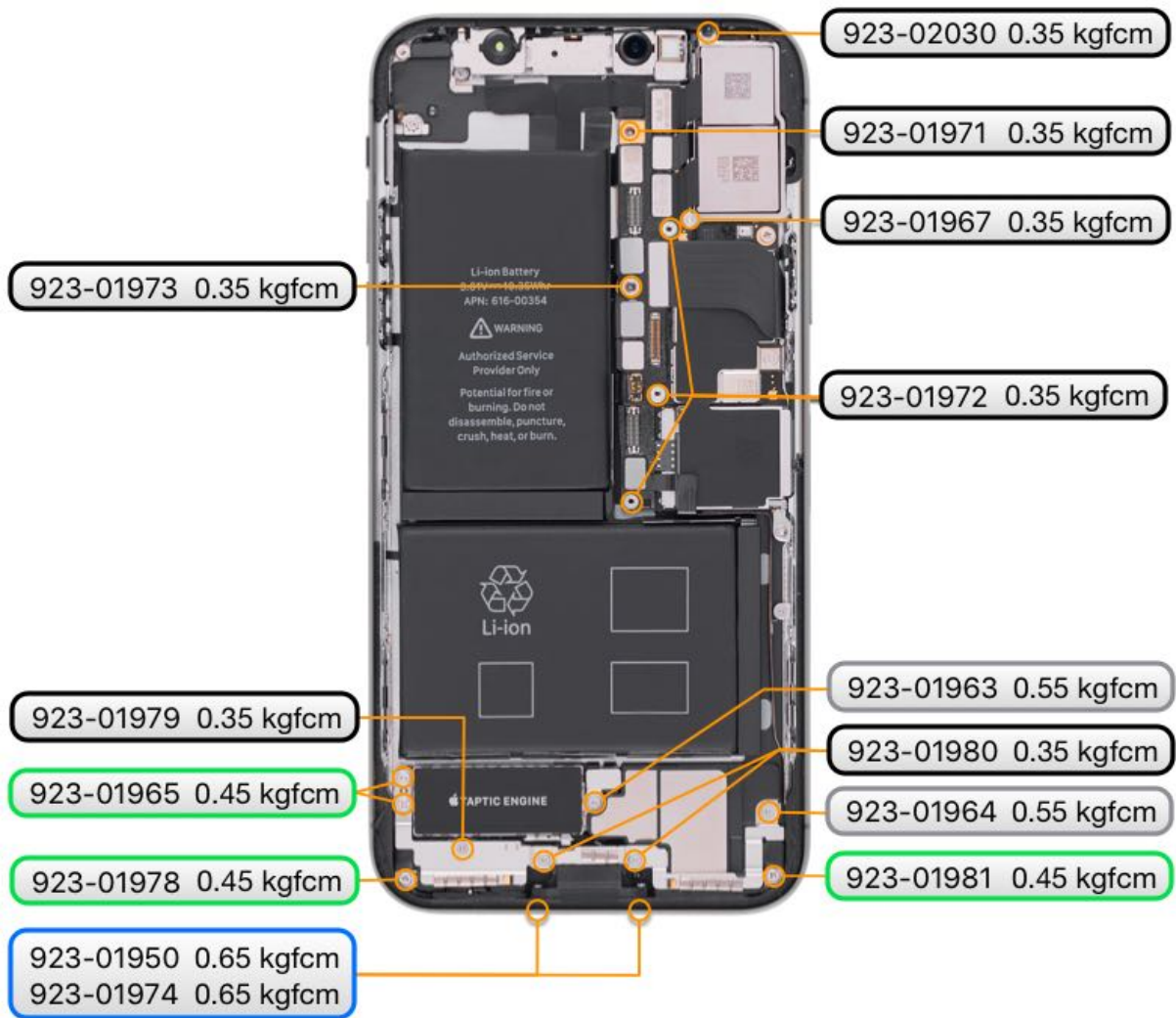
## Parts List

Description	Part Number	Kit Contents (order screws separately)	Screws
Battery Kit	661-08932	1 battery 1 battery adhesive pack	
Camera	661-08937		
Camera Cowling	923-01969	10 cowlings	923-02030 upper 923-01967 lower
Display Adhesive	923-01975 black	30 display adhesive sheets <b>Important:</b> Adhesive expires after one year and should be discarded. Each box of adhesive has a (9D) number on the top right corner of the part label. The first two numbers indicate the year and the second two numbers indicate the week. The expiration date is one year from the date in the (9D) number.	
Lower Cowling	923-02020		923-01965 upper left 923-01979 center left 923-01978 lower left 923-01980 center, center right 923-01964 upper right 923-01981 lower right
Security Screws		200 screws	923-01974 space gray 923-01950 silver
SIM Tray	923-01976 space gray 923-01977 silver		
Speaker	923-01962		
Speaker Cowling	923-01968		923-01963
Taptic Engine	923-01966		923-01965
Upper Cowling	923-01970		923-01971 upper left 923-01973 middle left 923-01972 upper right, middle right, lower

### Screw Diagram

Use the iPhone torque driver (black) for screws marked with a black outline.  
 Use the iPhone torque driver (blue) for screws marked with a blue outline.  
 Use the iPhone torque driver (green) for screws marked with a green outline.  
 Use the iPhone torque driver (gray) for screws marked with a gray outline.





# iPhone X Repair Video List

The iPhone X features a new internal design. In these videos, learn about these changes and how to properly replace internal components in the course of a repair.

- [iPhone X Open Device Video](#)
- [iPhone X Speaker Replacement Video](#)
- [iPhone X Taptic Engine Replacement Video](#)
- [iPhone X Battery Replacement Video](#)
- [iPhone X Camera Replacement Video](#)

For issues with video content or playback, email the **AppleCare Media Production** team at **servicevideos@group.apple.com**.

**Note:** You may not receive a response, but all comments will be reviewed and investigated as needed.



# SIM Tray

## First Steps

- Turn off the iPhone.

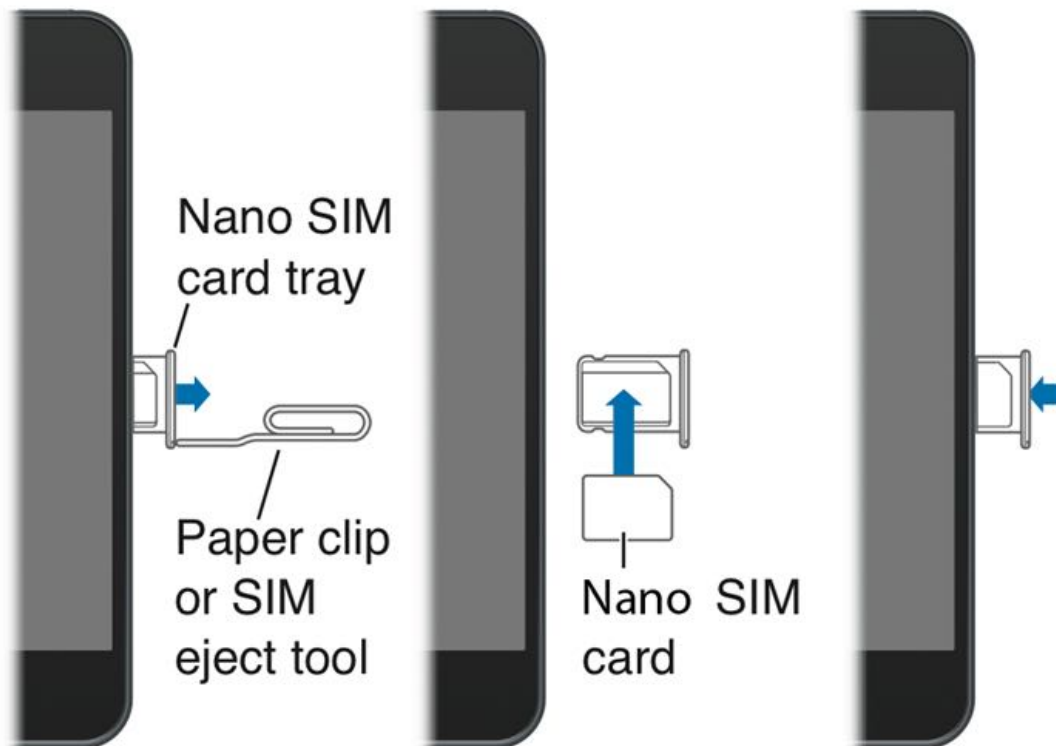


## Tools

- SIM removal tool (922-8417) or paper clip (size #1)

## Steps For Removal

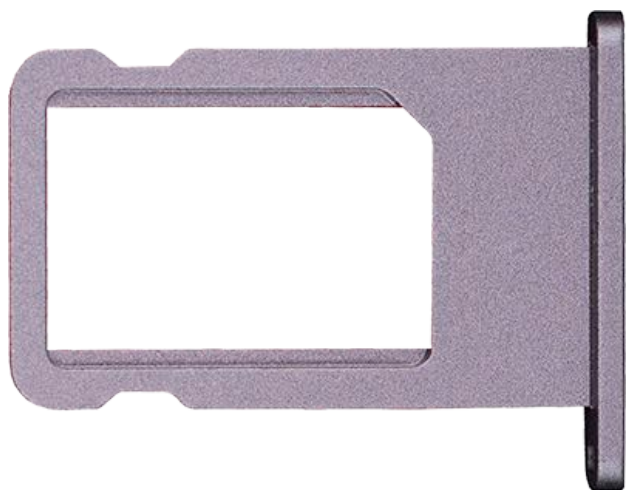
1. Insert the end of a SIM removal tool (922-8417) or a small, thin paper clip (size #1) into the hole on the SIM tray.
2. Push the tool straight in firmly until the tray pops out.



## Steps For Reassembly

Note the orientation of the tray and SIM card before inserting it into the iPhone.

**Caution:** Do not force the SIM tray into position, as it could cause internal damage to the iPhone.



# Open Device

## First Steps

- Refer to the [Visual/Mechanical Inspection \(VMI\) Guide](#) to determine whether any accidental damage is present.
- Remove any cases or screen protectors.
- Follow electrostatic discharge (ESD) precautions.
- Turn off the iPhone.



**Warning:** If the enclosure is separated due to a swollen battery, **stop the repair**. Do not remove the battery from the device. Replace the whole unit. Refer to articles [TP328: iPhone Safety](#) and [HT204762: Enclosure separation due to expanded battery](#).

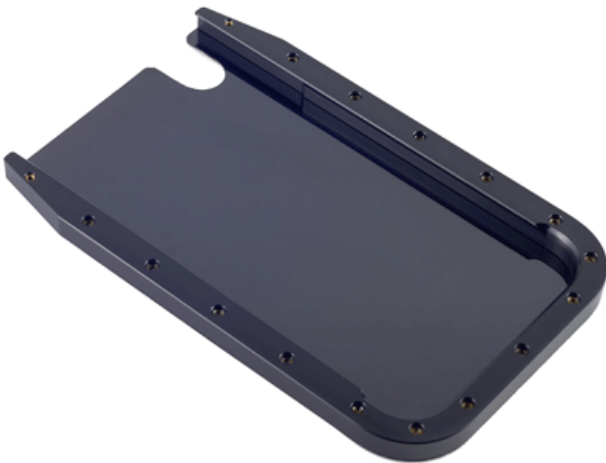
**Warning:** If the display glass is broken, put on safety glasses and material handling gloves. Use a vacuum cleaner to remove any shards present on the workspace or the display. Affix a protective display cover or packing tape before removal to prevent injury or scattering of glass. Do not install the display cover or tape over the edge of the display.

When installing a 5.8-inch Display Protective Cover (923-01921), firmly press the cover onto the broken display to remove air bubbles and work the adhesive into the cracks in the glass. The cover should be left to settle into place longer for more damaged displays, up to 12 minutes, before attempting to remove the display. The longer the protective cover is left on the display, the stronger the bond between the cover and the broken glass.



If the back glass is broken, adhere a 5.8-inch Back Protective Cover (923-02233) before attempting repair. If the protective cover does not adhere to the iPhone or if there is no glass for the film to adhere to, do not attempt a repair. Devices with this type of damage will require a whole unit replacement.

Then place the iPhone in the 5.8-inch support frame (923-01922) before attempting to open the device. If the device does not fit in to the support frame, do not attempt a repair. Devices with this type of damage will require a whole unit replacement.

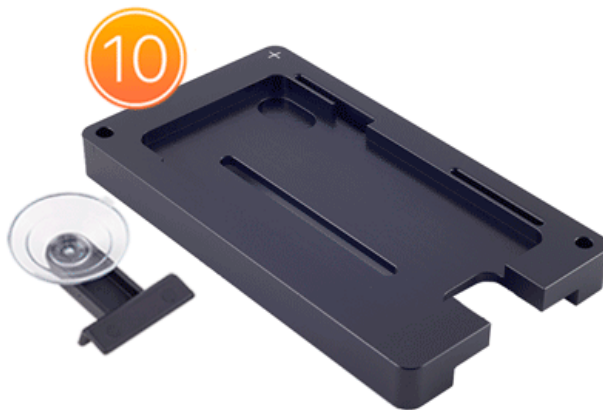
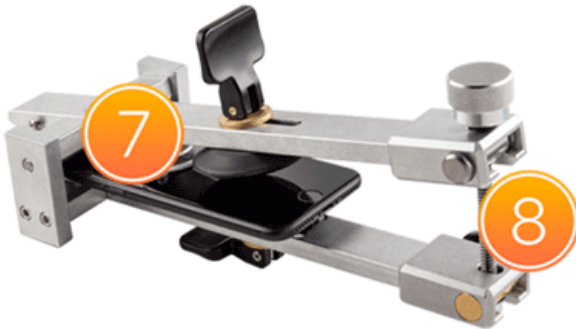


For video instruction, refer to article [SV359: iPhone X Open Device Video](#).



## Tools

1. iPhone torque driver (black) (923-0248)
2. iPhone torque driver (blue) (923-0448)
3. Security bit (923-0247)
4. MicroStix bit (923-01290)
5. JCIS bit (923-0246) for cross-head screws
6. Black stick (922-5065)
7. Universal Display Removal Fixture (923-01385)
8. iPhone 6s and 6s Plus Display Removal Fixture Adapter (923-00652)
9. Adhesive Cutter (923-01915)
10. 5.8-inch Repair Tray (923-01920)
11. Display Press (661-08916)



## Steps For Removal

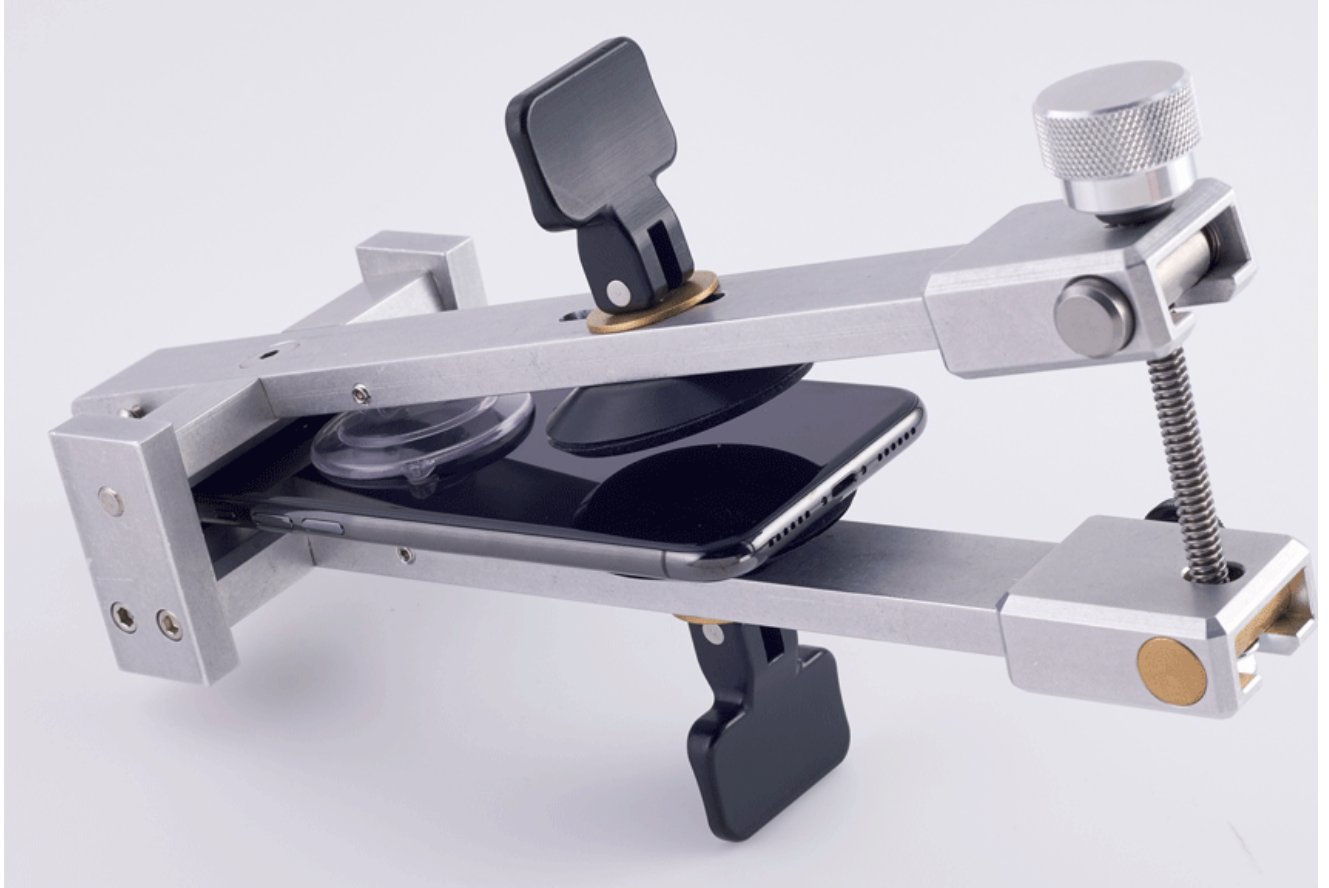
1. Use the iPhone torque driver (black) and security bit to remove and discard two security screws, one from each side of the Lightning connector.



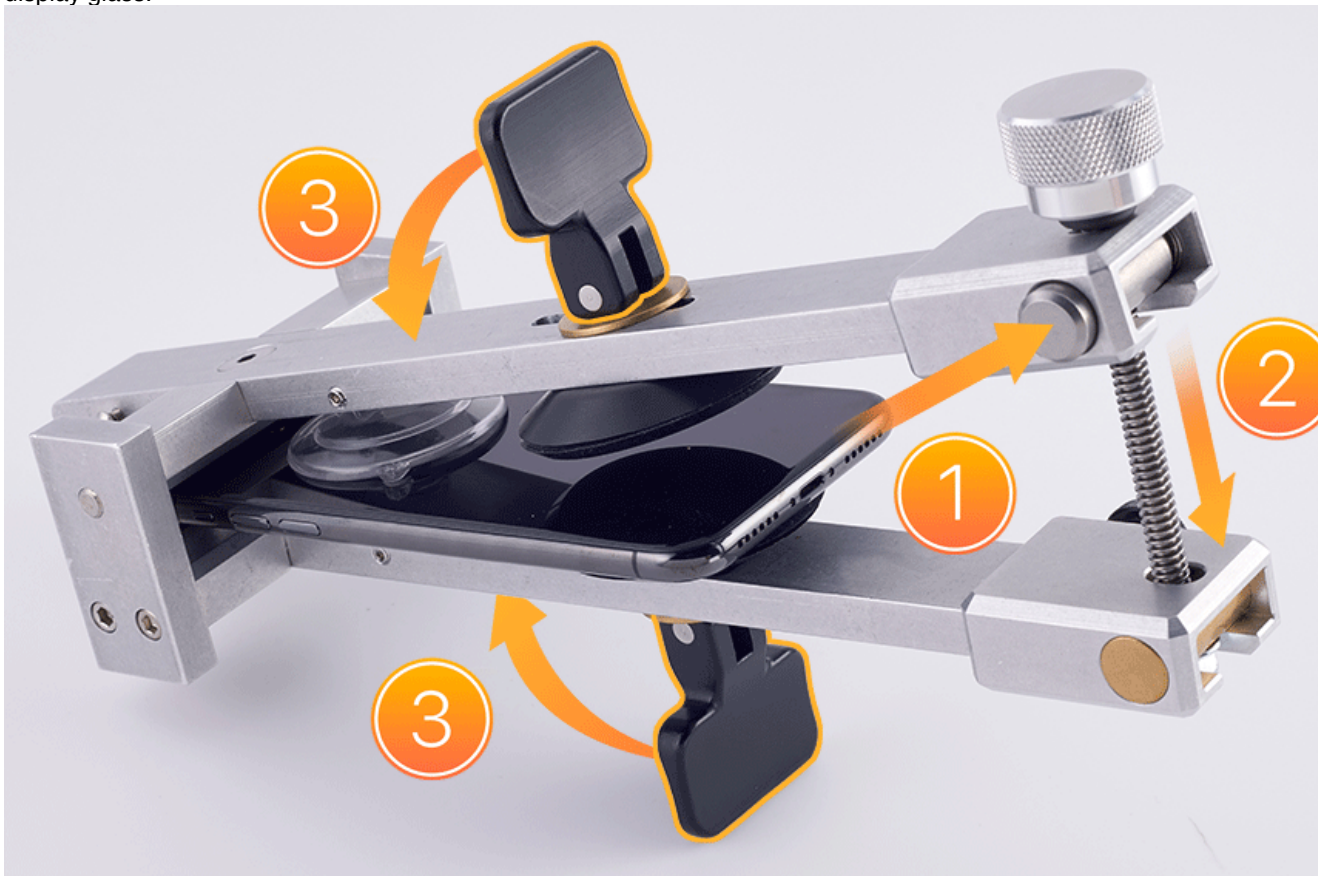
2. Secure the iPhone 6s and 6s Plus Display Removal Fixture Adapter to the Universal Display Removal Fixture. Be sure that the handles of the fixture are fully inserted into the adapter and the thumb screws are tight.
3. Adjust the suction cup to the farthest point from the pivot and as close to the bottom of the display without overlapping the edge. Adjust the suction cup on the back of the device to align with the position of the one on the display. Press the iPhone down to secure the lower suction cups.



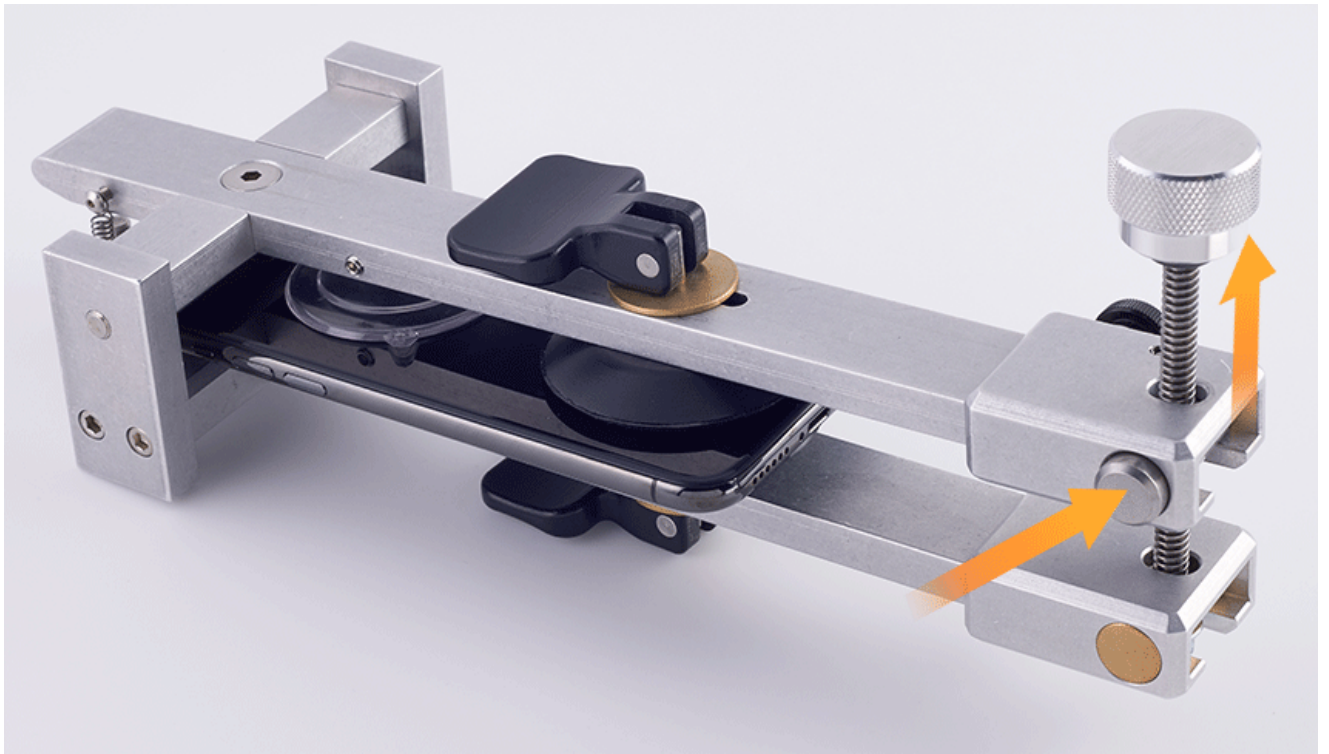
**Caution:** Be sure to use an updated Universal Display Removal Fixture and Display Removal Fixture Adapter with iPhone X. Other fixtures may cause damage.



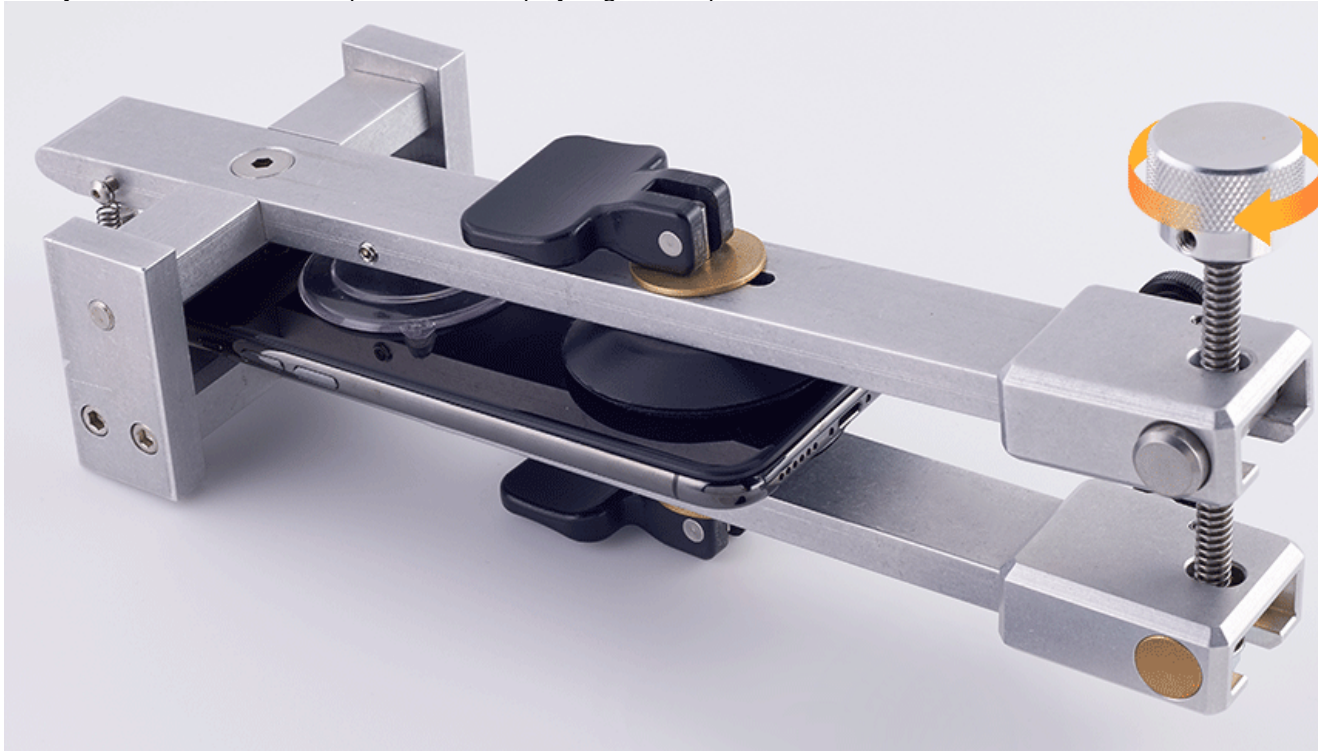
4. Press and hold the release button on the adapter, then press the lever down to secure the upper suction cups to the display glass.



5. Press and hold the release button on the adapter, then slowly separate the metal bars until resistance is felt. Do not use excessive force.

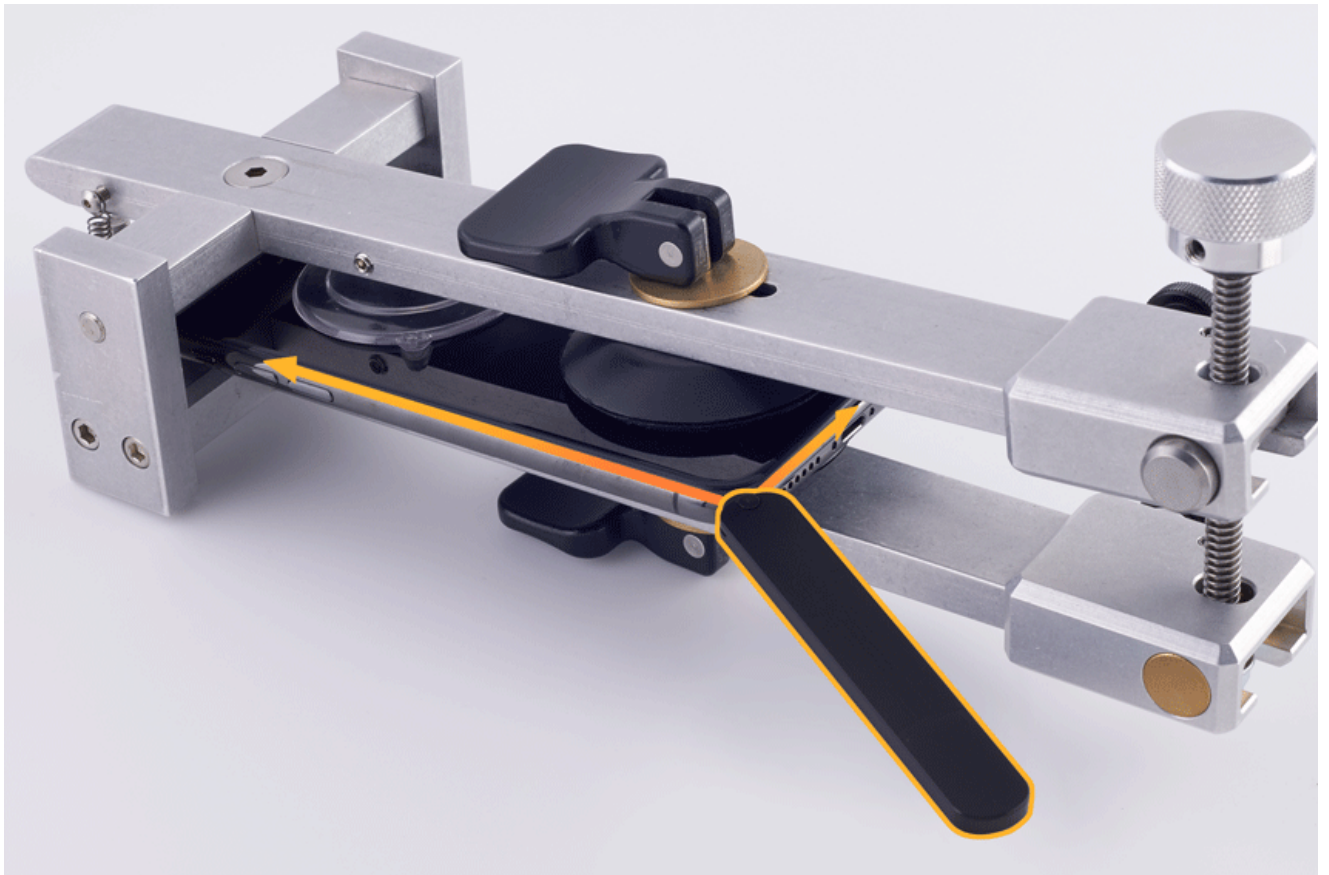


6. Slowly turn the knob on the adapter until the display begins to separate from the enclosure.

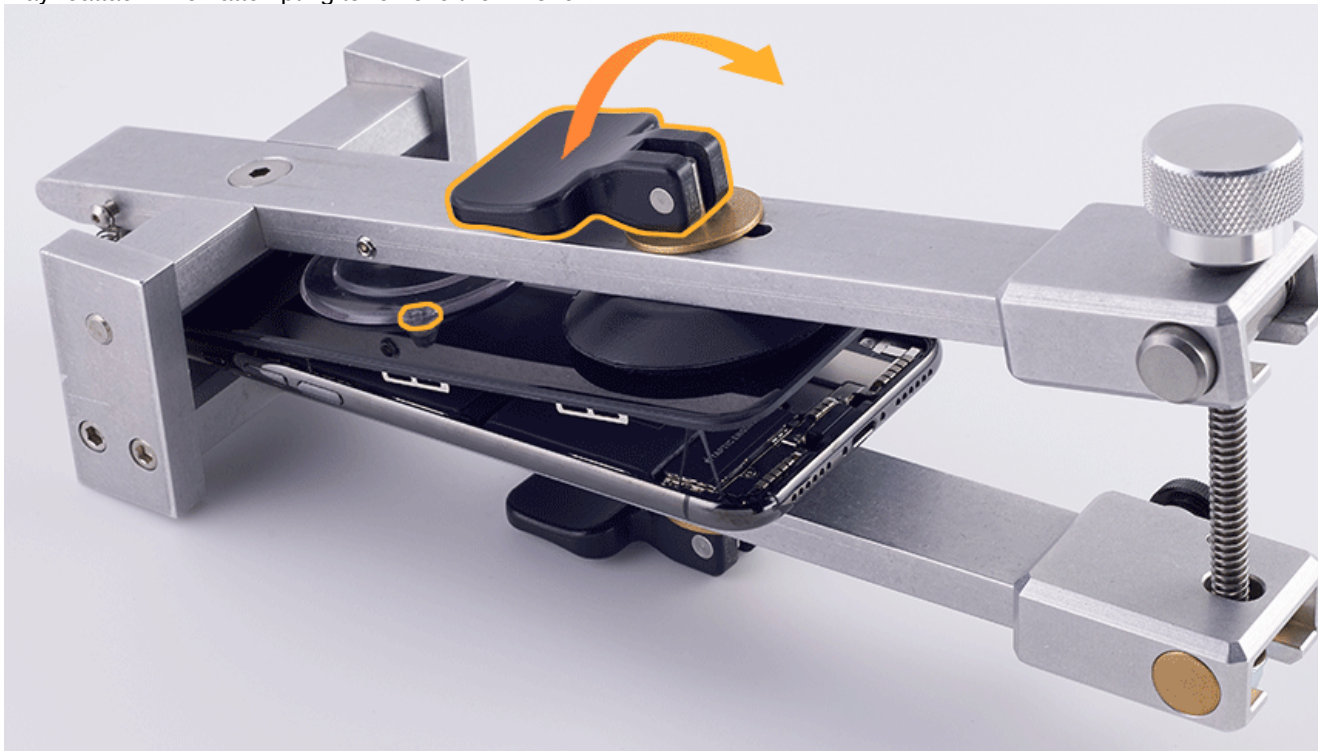


7. Insert the Display Adhesive Cutter between the display and the enclosure until the edge of the cutter is inside the enclosure. Run the cutter between the display and the enclosure until the display is free.



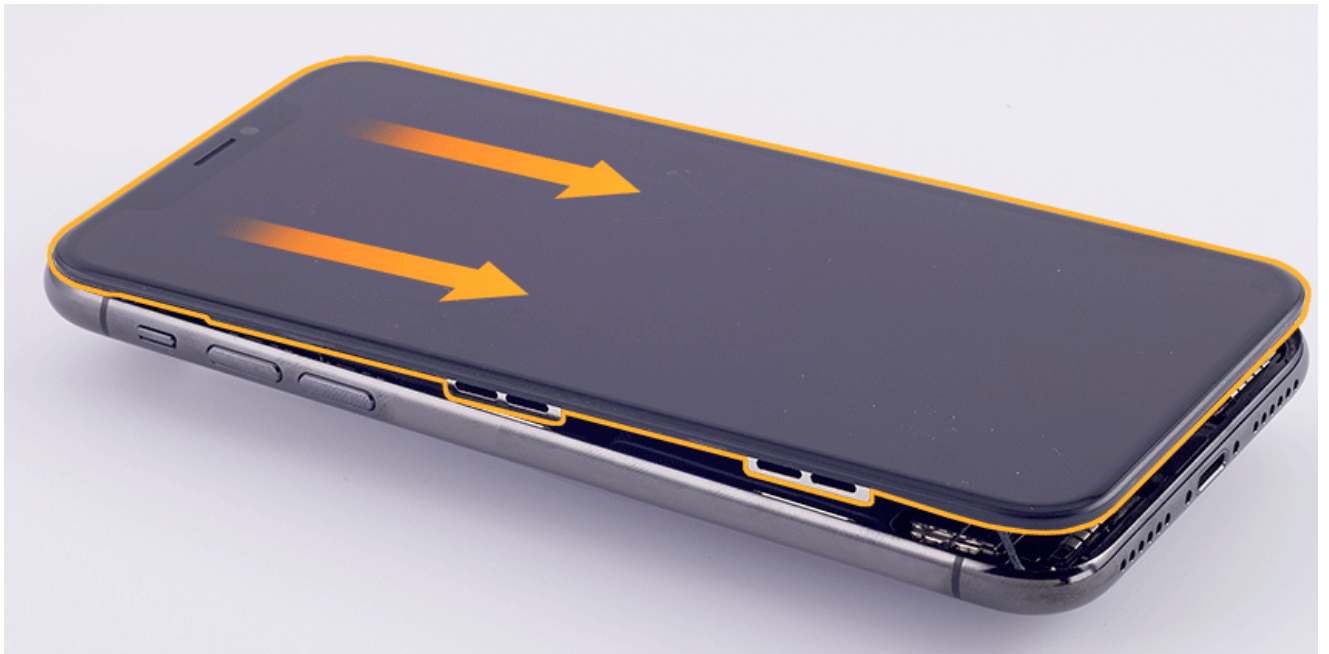


8. Loosen the four suction cups to release the display and the enclosure from the fixture. **Note:** The bottom suction cup may reattach when attempting to remove the iPhone.



9. Gently slide the display slightly toward the bottom of the device until the clips release, then tilt the bottom of the display up. **Caution:** Do not pry display.





10. Insert the Display Adhesive Cutter between the display and the enclosure near the top of the display. Run the cutter between the display and the enclosure until the display is free. **Note:** Use the cutter at the angle shown in the image.



**Important:** To avoid damaging the display flexes, do not tilt the display more than five degrees.



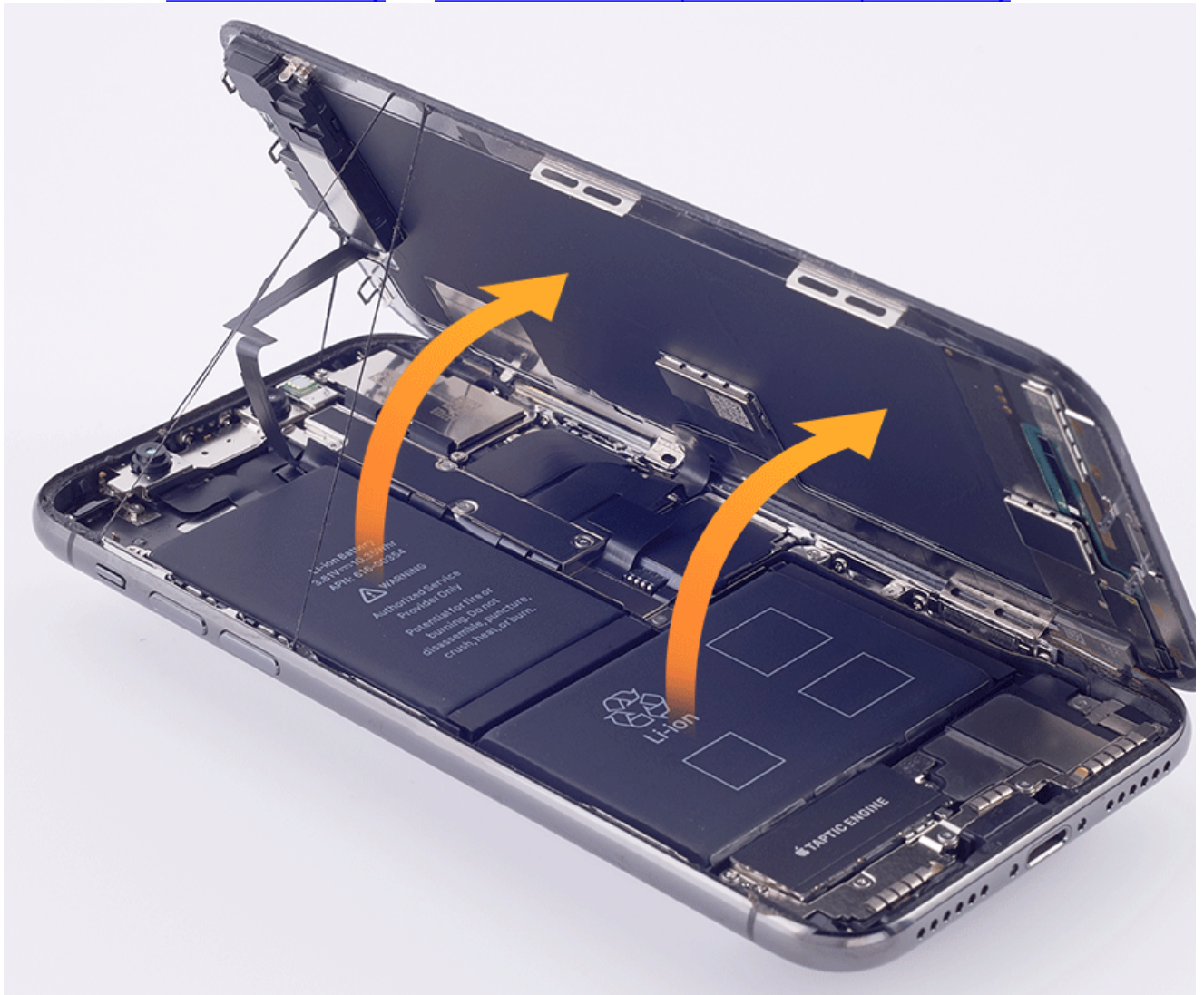
11. Carefully tilt the display to the right.



**Caution:** Be sure that the display clips are released before tilting the display to avoid damage to the enclosure or display. Do not damage the display flexes while lifting the display.

**Warning:** If the battery is dented, punctured, swollen, or otherwise damaged, then **stop the repair**. Do not remove the battery from the device. Reassemble and replace the whole unit.

Refer to articles [TP328: iPhone Safety](#) and [HT204762: Enclosure separation due to expanded battery](#).



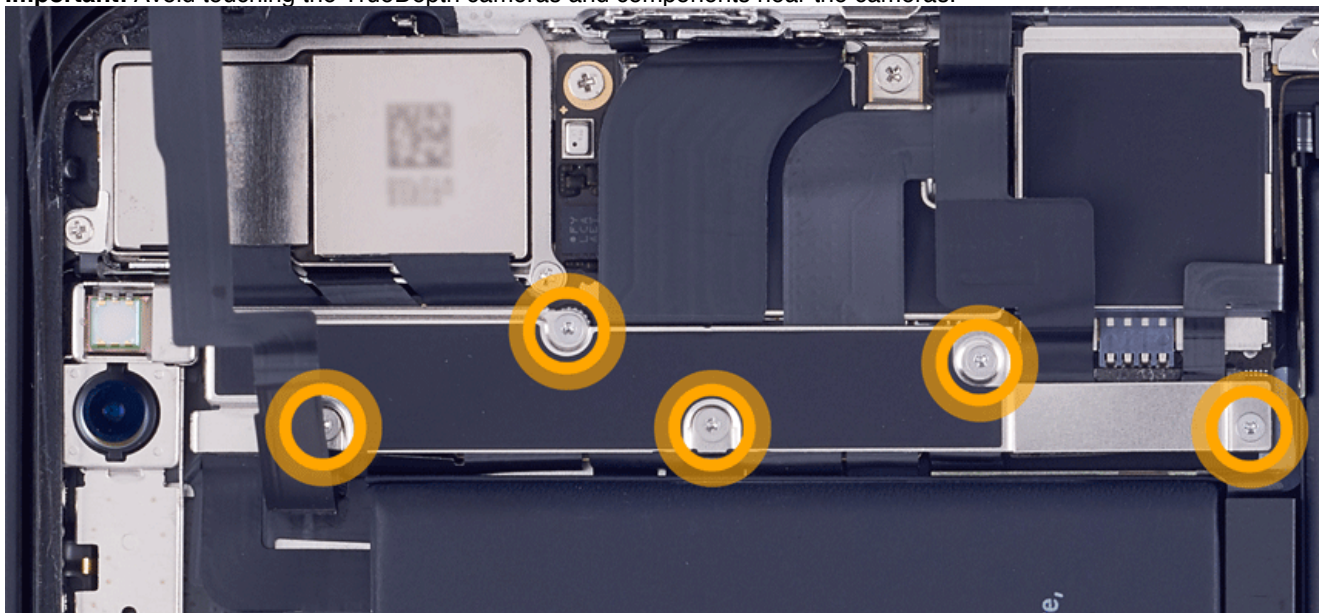
12. Insert the iPhone into the repair tray. Gently press along on the receiver and bottom edge of the display to secure the display to the suction cup.

**Important:** Do not press the back of the display to secure the display to the suction cup. Pressing the back of the display may affect 3D Touch functionality and image quality.



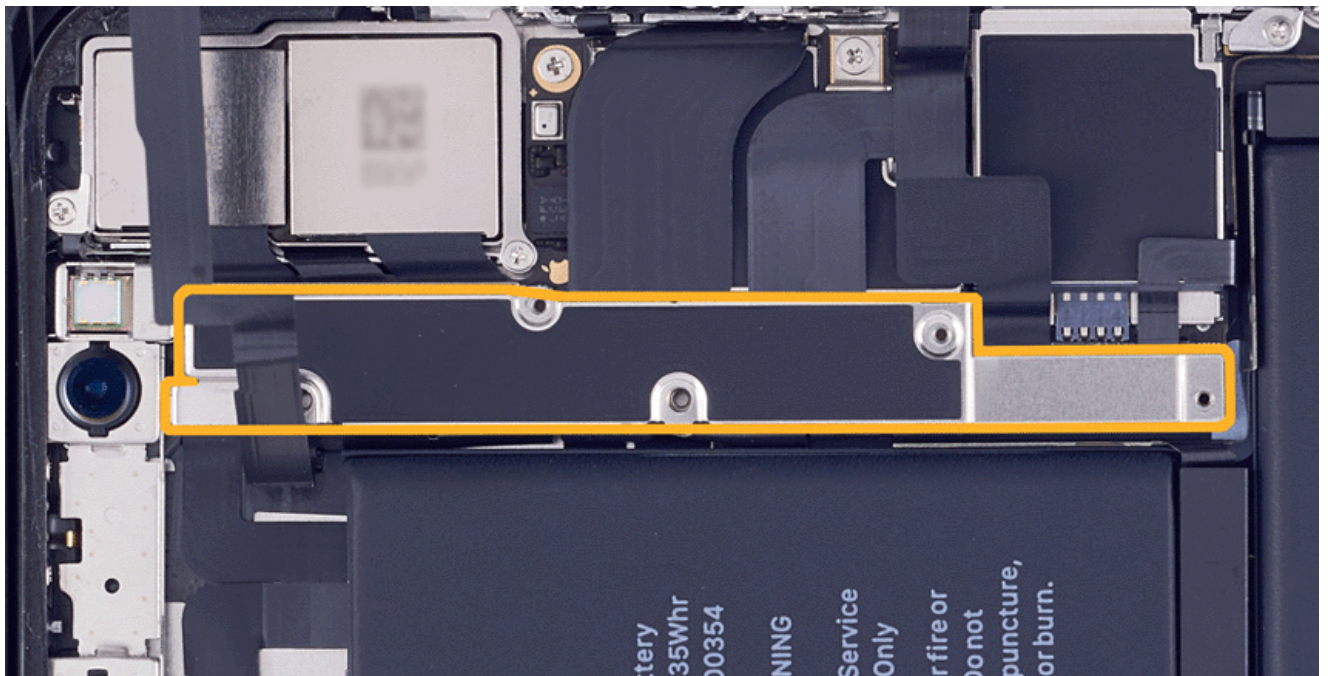


13. Use the iPhone torque driver and MicroStix bit to remove and discard five trilobe screws from the upper cowling.  
**Important:** Avoid touching the TrueDepth cameras and components near the cameras.

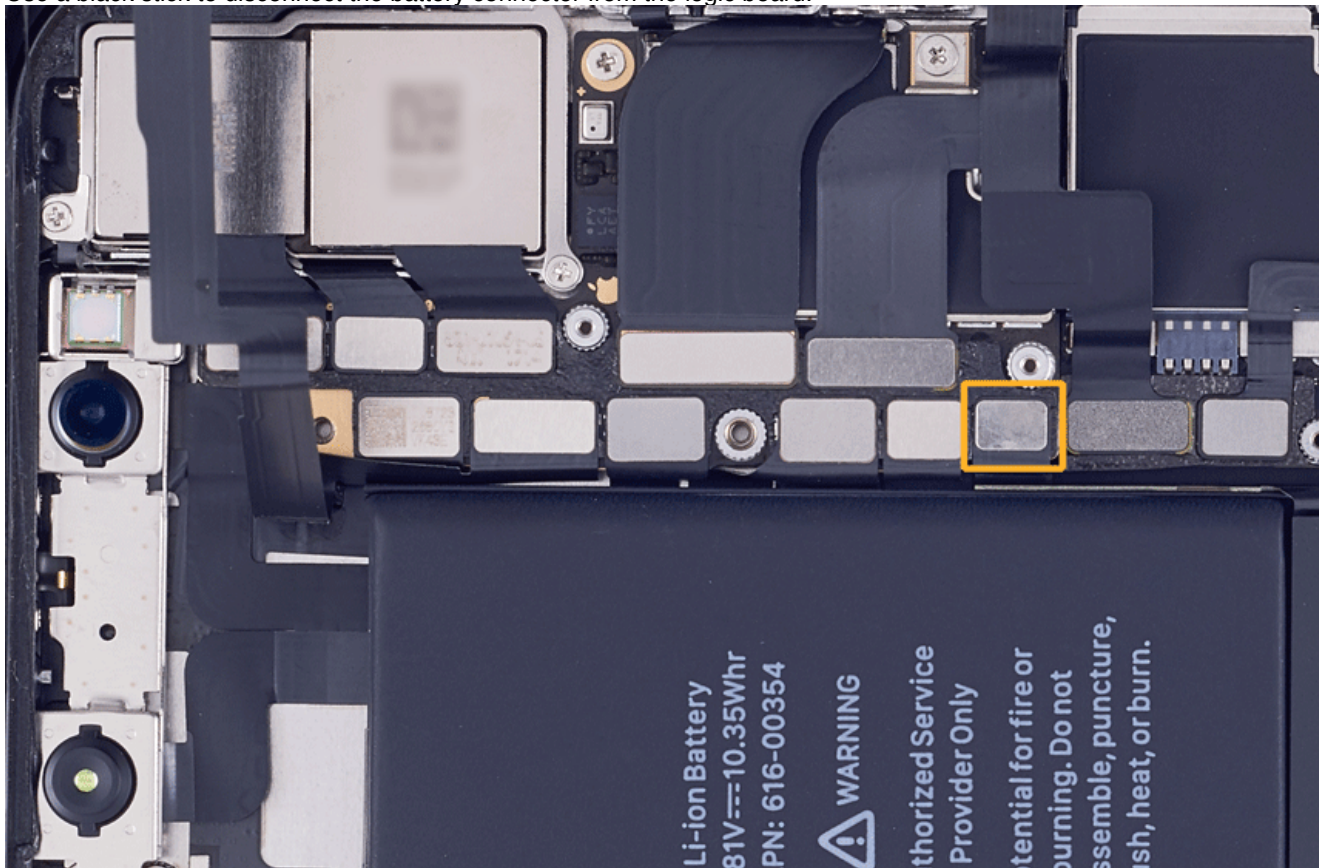


14. Remove the upper cowling. Save it for reuse.

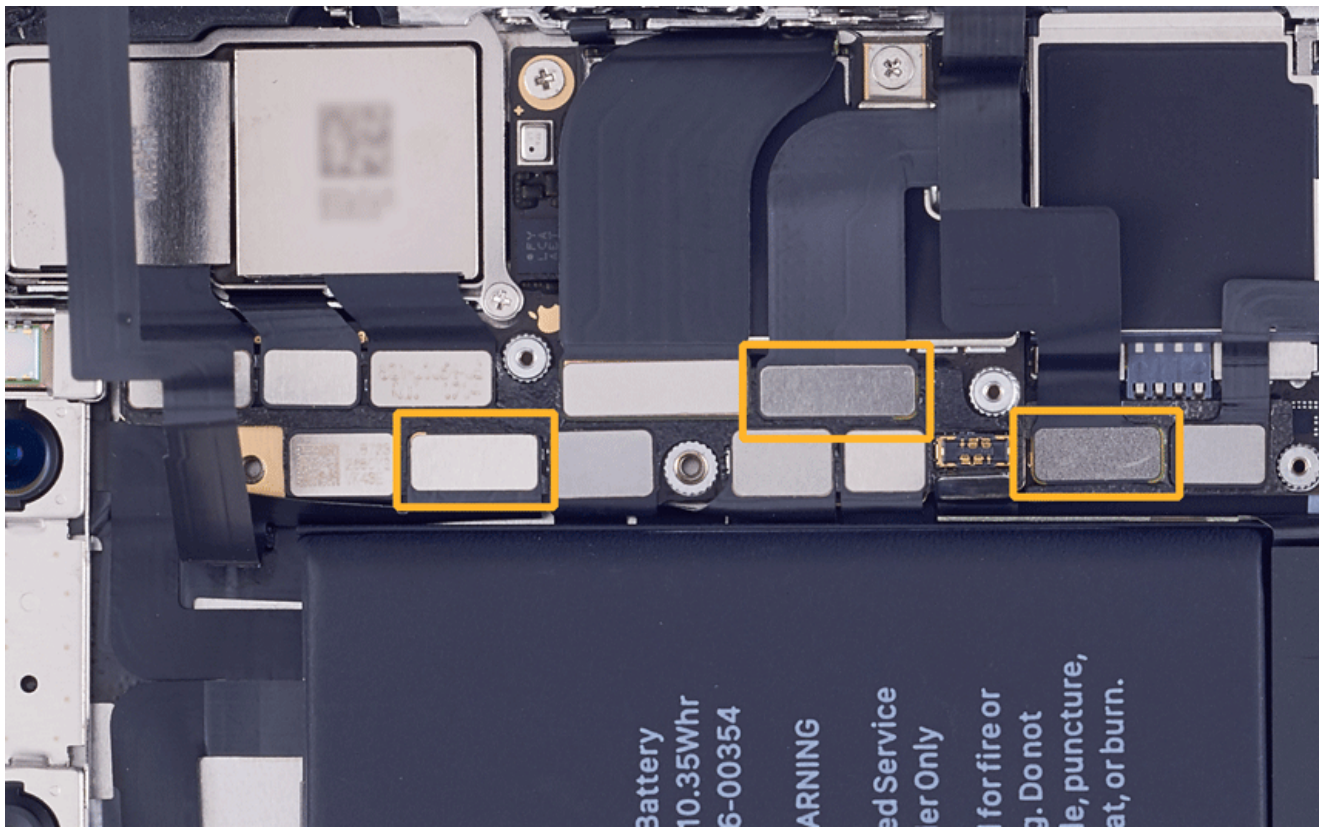




15. Use a black stick to disconnect the battery connector from the logic board.



16. Use a black stick to disconnect the three display flex connectors. Gently separate the left flex from the adhesive on the enclosure.

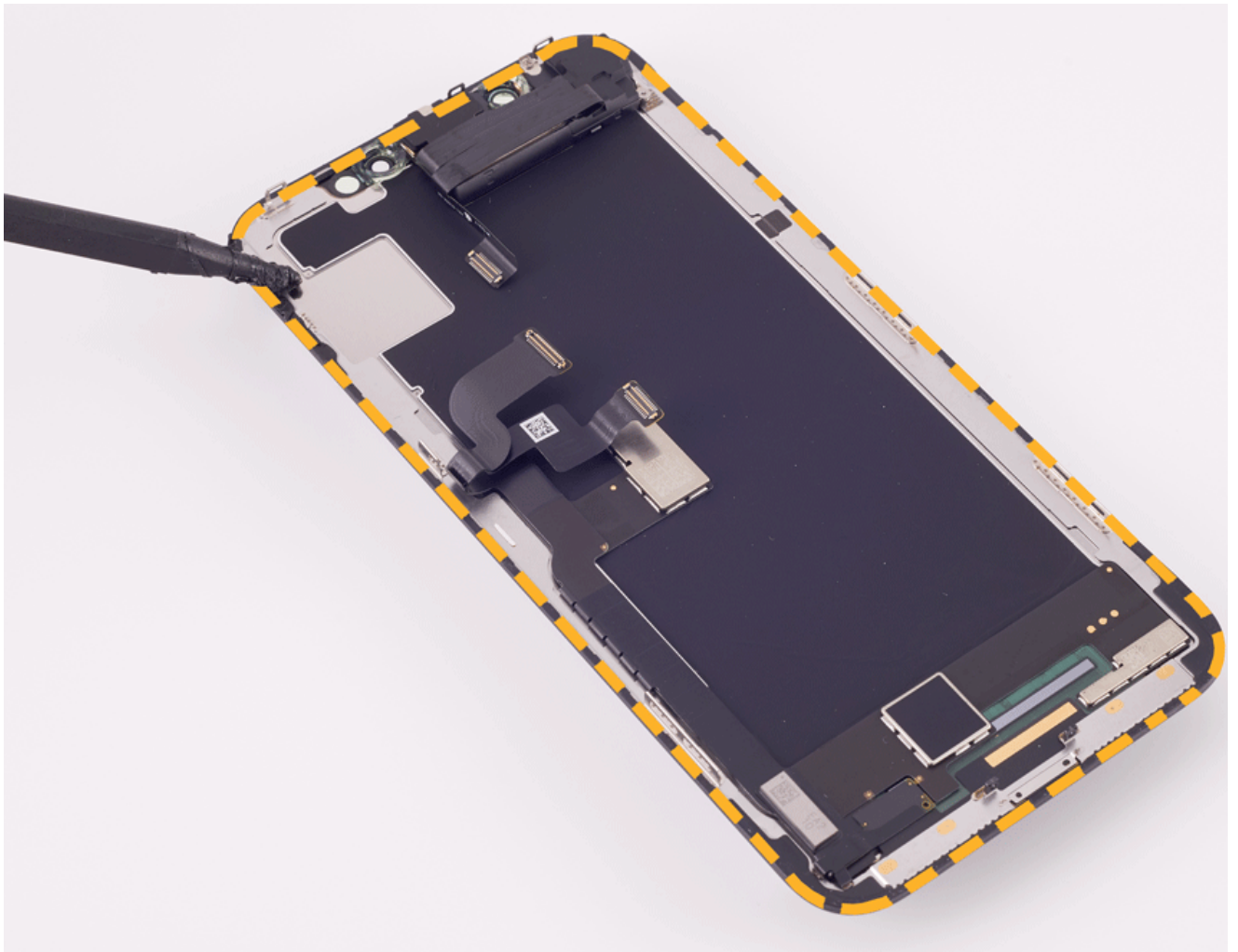


17. Remove the display assembly from the enclosure.
18. Use a black stick to remove adhesive residue from the display and the enclosure.

**Important:** Clean the enclosure and the display thoroughly to ensure a proper seal during reassembly. To review video instruction for the recommended adhesive removal method, refer to article [SV359: iPhone X Open Device Video](#).







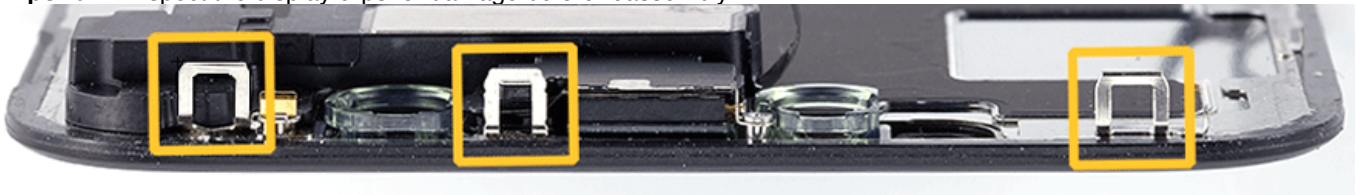
**Caution:** Do not use IPA wipes on the display. IPA may damage the display and affect image quality.

Use IPA wipes to clean any adhesive residue from the enclosure. **Important:** Avoid touching the TrueDepth cameras and components. Avoid the grounding pads near the bottom of the device.



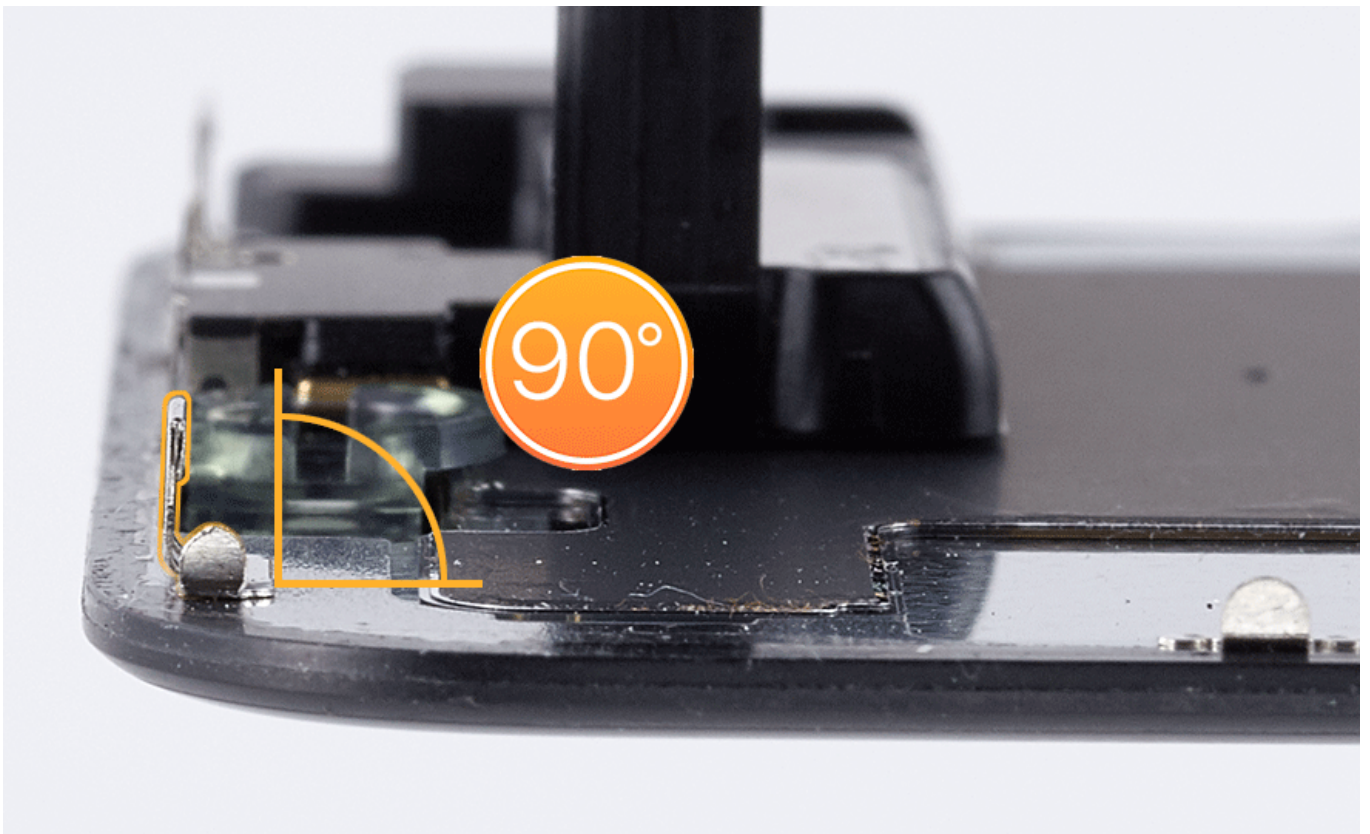
## Steps For Reassembly

**Important:** Inspect the display clips for damage before reassembly.



Verify the clips are not bent or damaged.





**Important:** Make sure that all adhesive is removed from the display and enclosure before applying new adhesive.

1. Align the display adhesive (923-01975) with the enclosure. **Important:** The flexible release liner must face the enclosure.

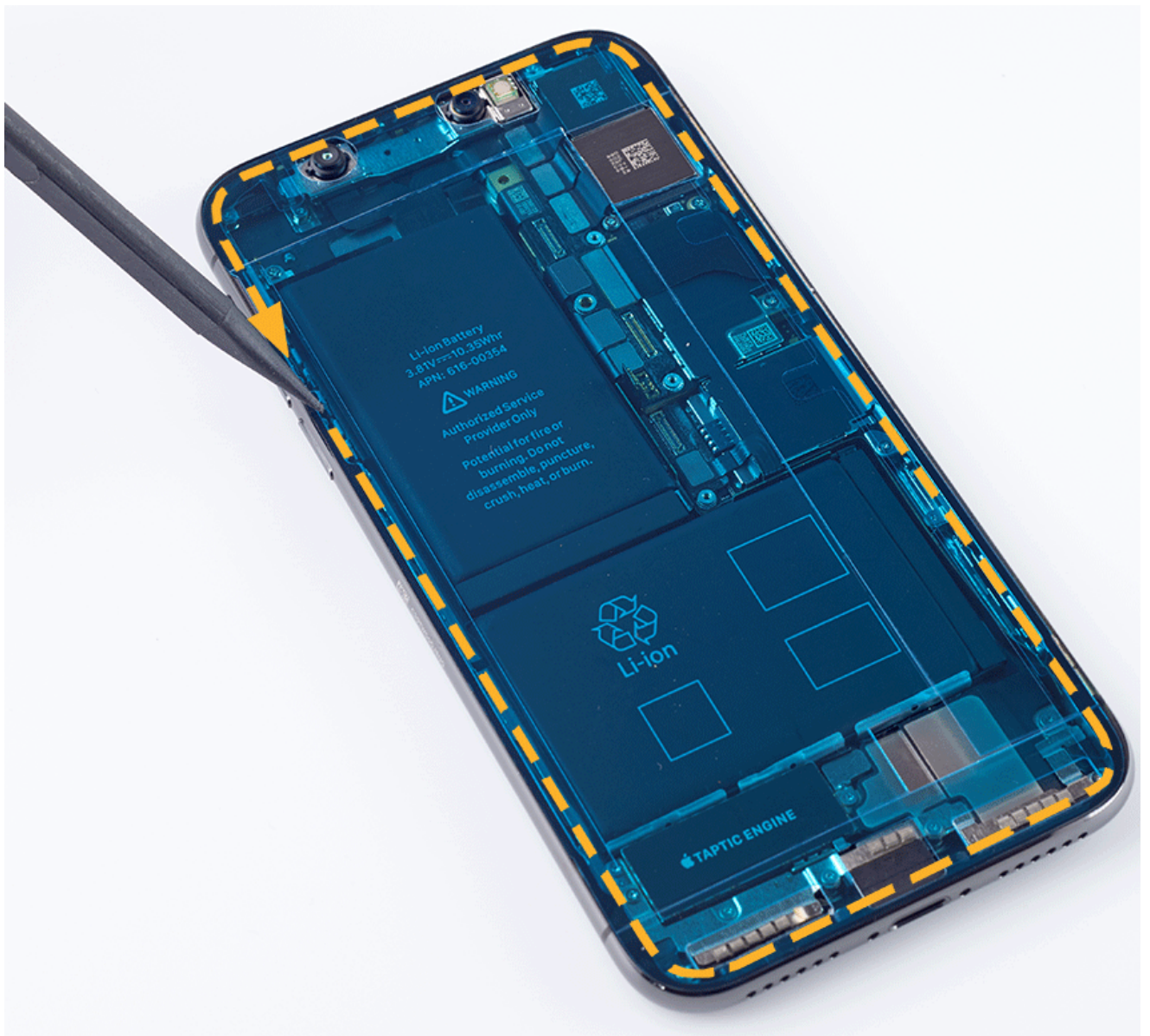


2. Slowly remove the flexible release liner while pressing the adhesive into the enclosure. **Important:** Do not remove the top release liners.

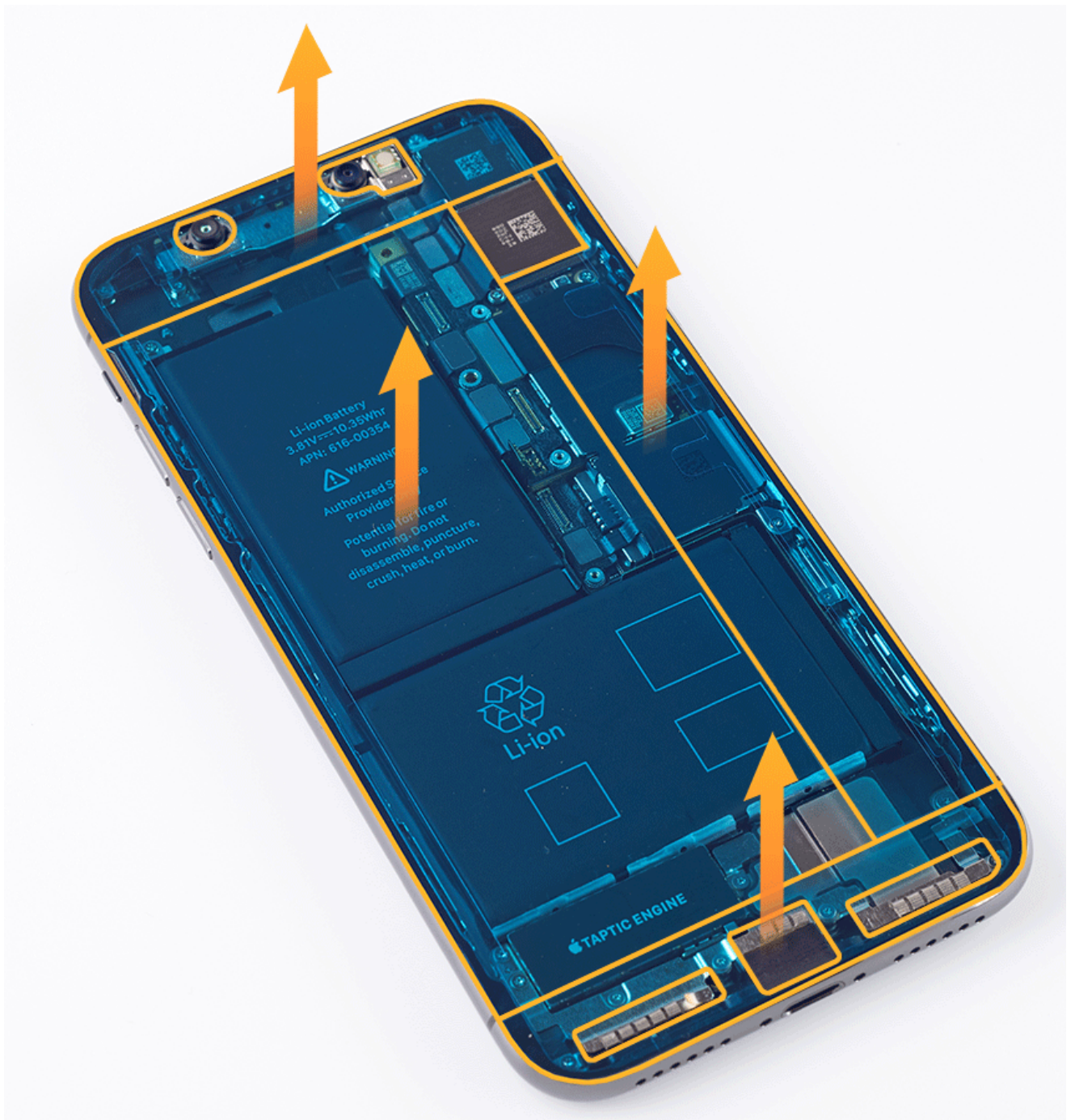


3. Use a black stick to adhere the display adhesive to the enclosure.





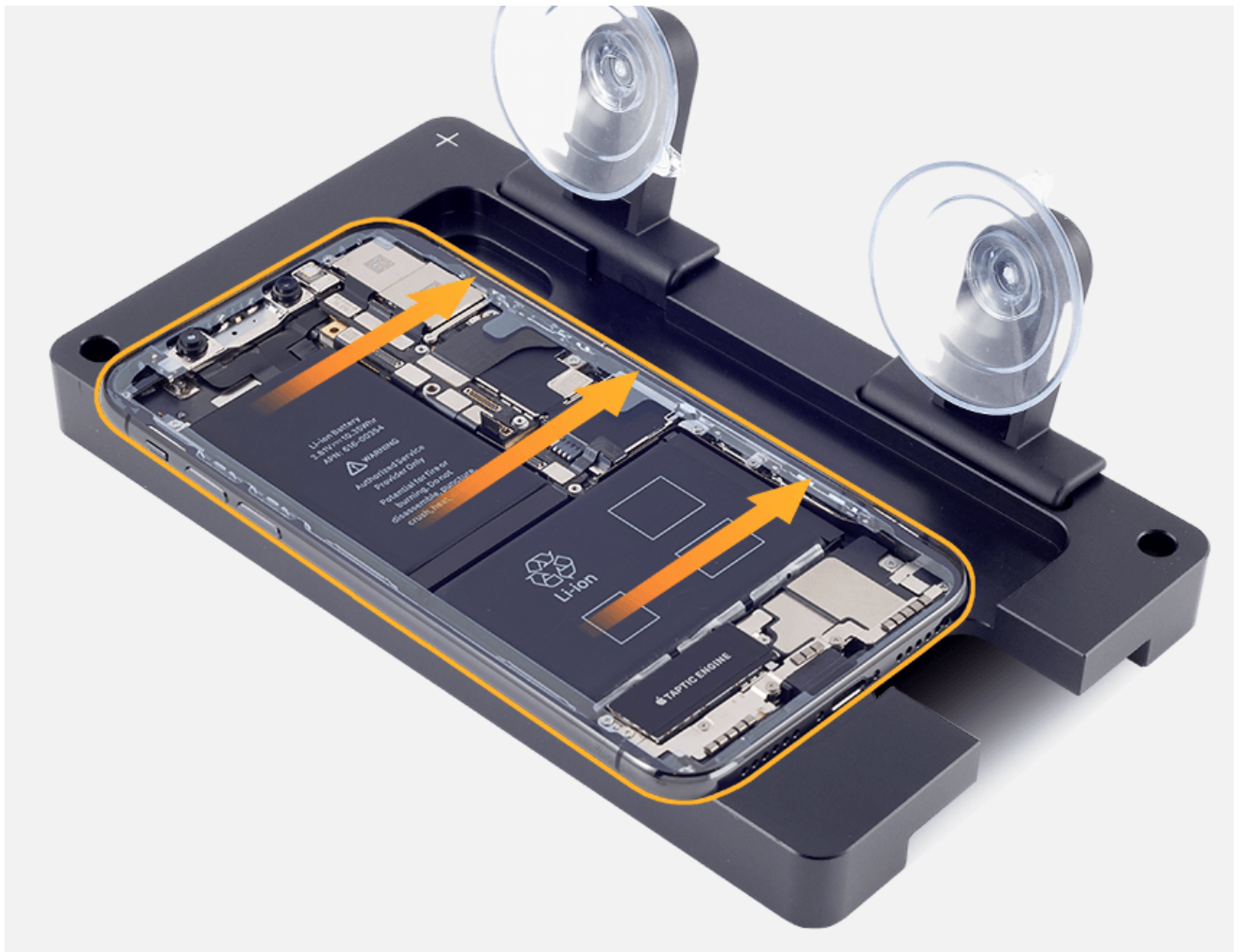
4. Remove the center section of the top release liner first, followed by the three sections running along the top, right, and bottom edges. **Important:** Do not remove the remaining release liners.



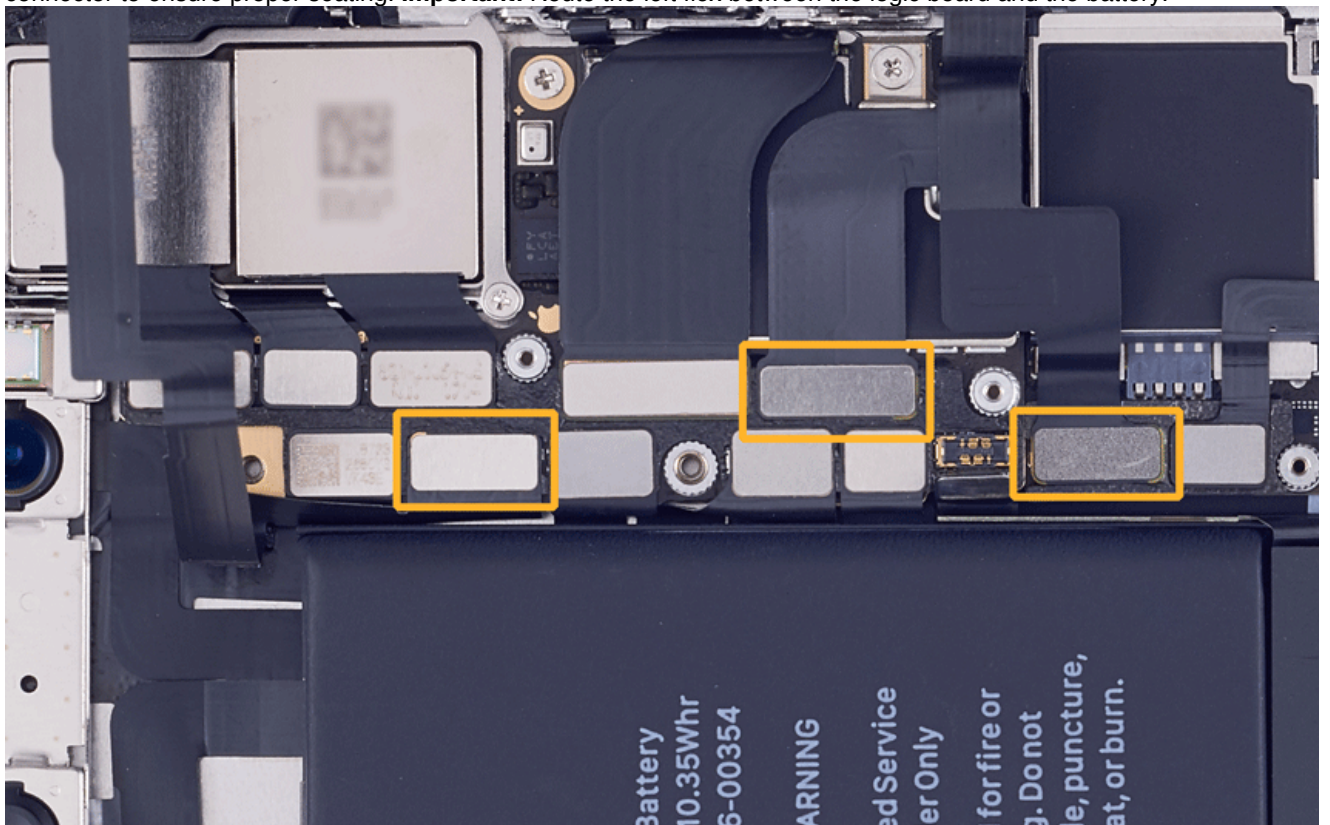
5. Insert the iPhone into the repair tray. Then gently press along the edges of the display to secure the display to the suction cups.

**Important:** Do not press the back of the display to secure the display to the suction cup. Pressing the back of the display may affect 3D Touch functionality.



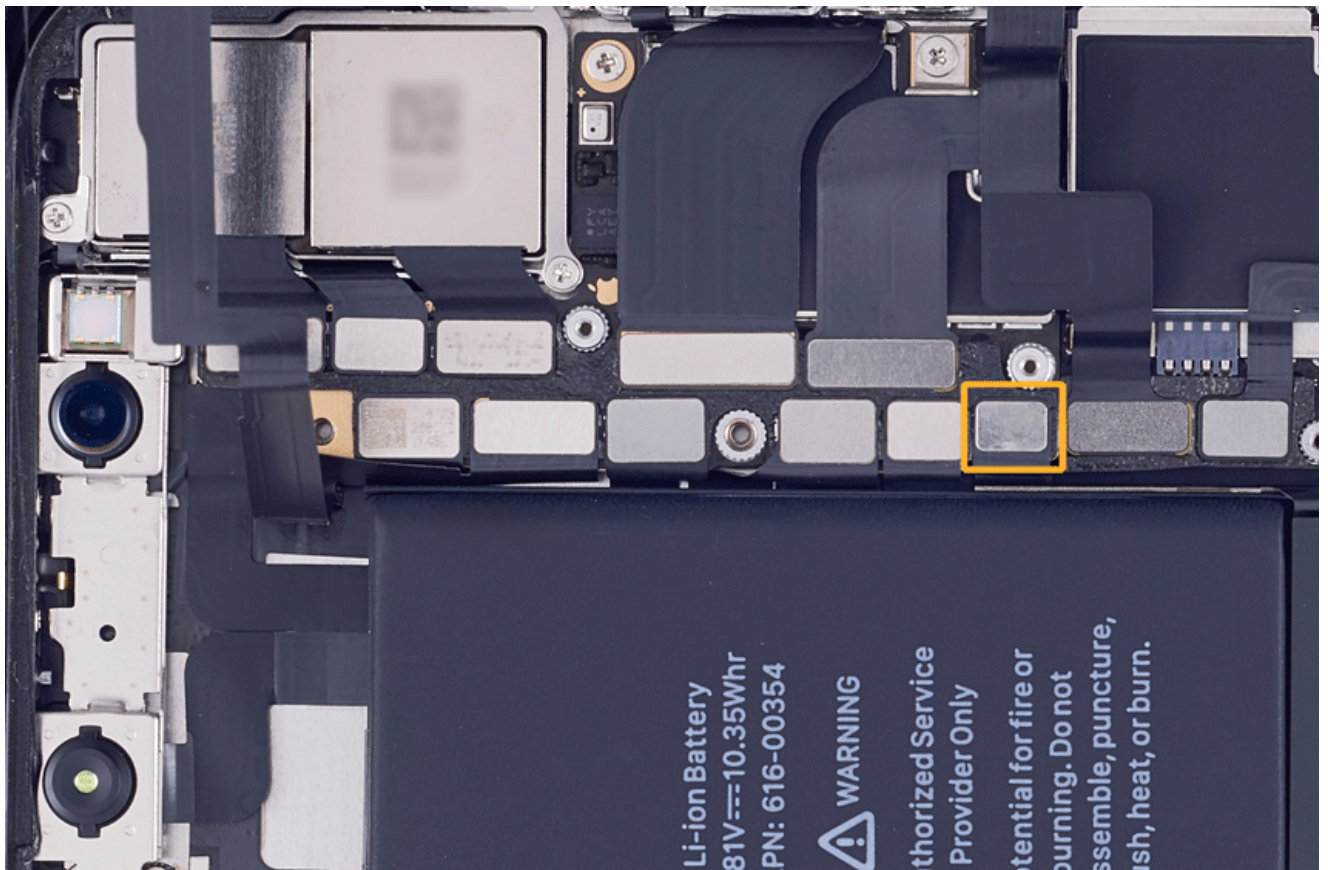


6. Connect three display connectors. Press down gently, applying even pressure along the entire length of each connector to ensure proper seating. **Important:** Route the left flex between the logic board and the battery.

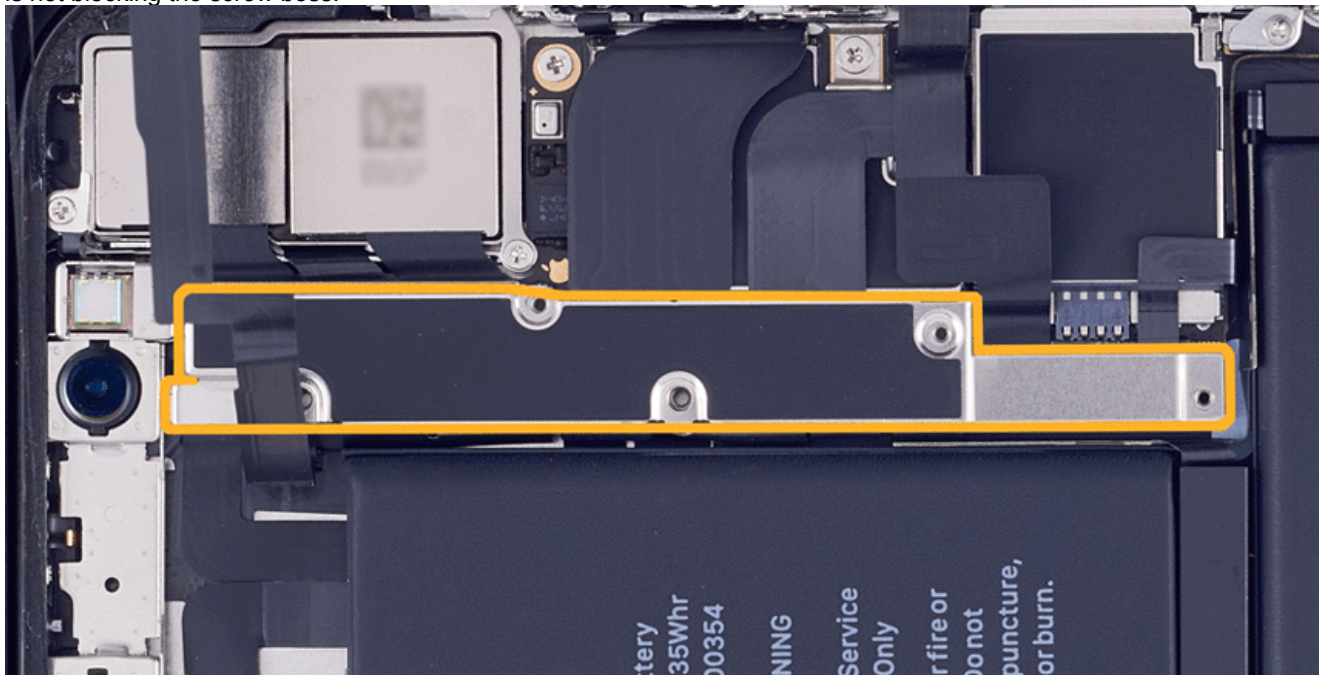


7. Connect the battery connector to the logic board.



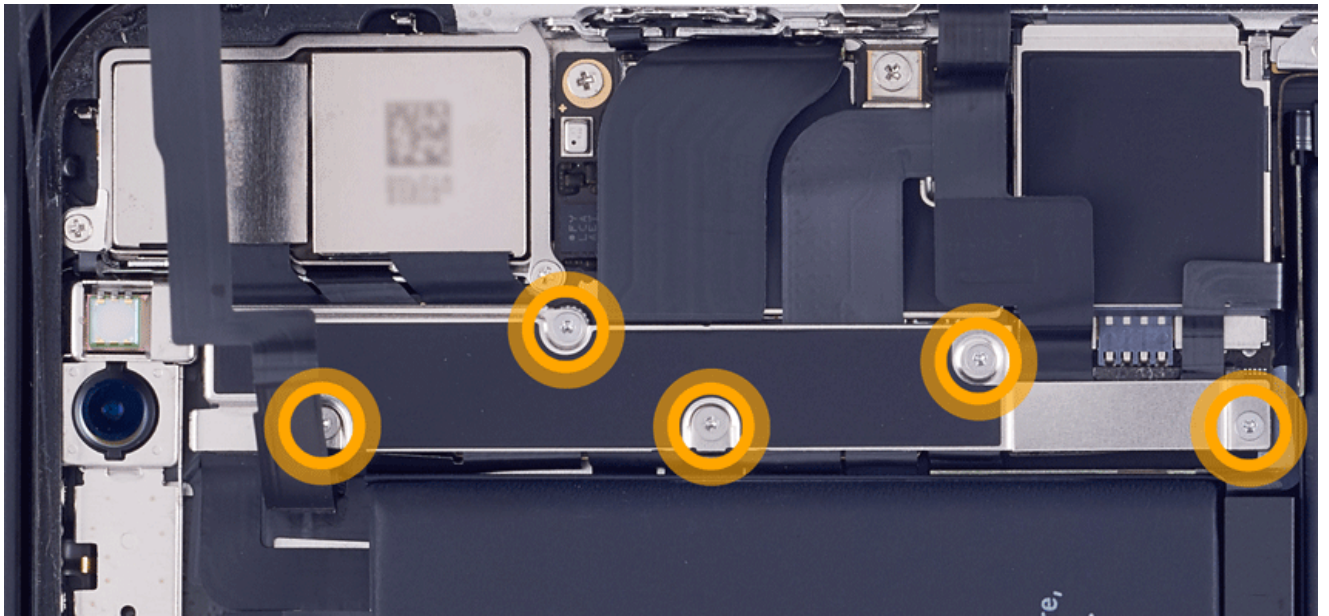


8. Position the upper cowling (923-01970) over the connectors. **Important:** Make sure the left flex is routed correctly and is not blocking the screw boss.

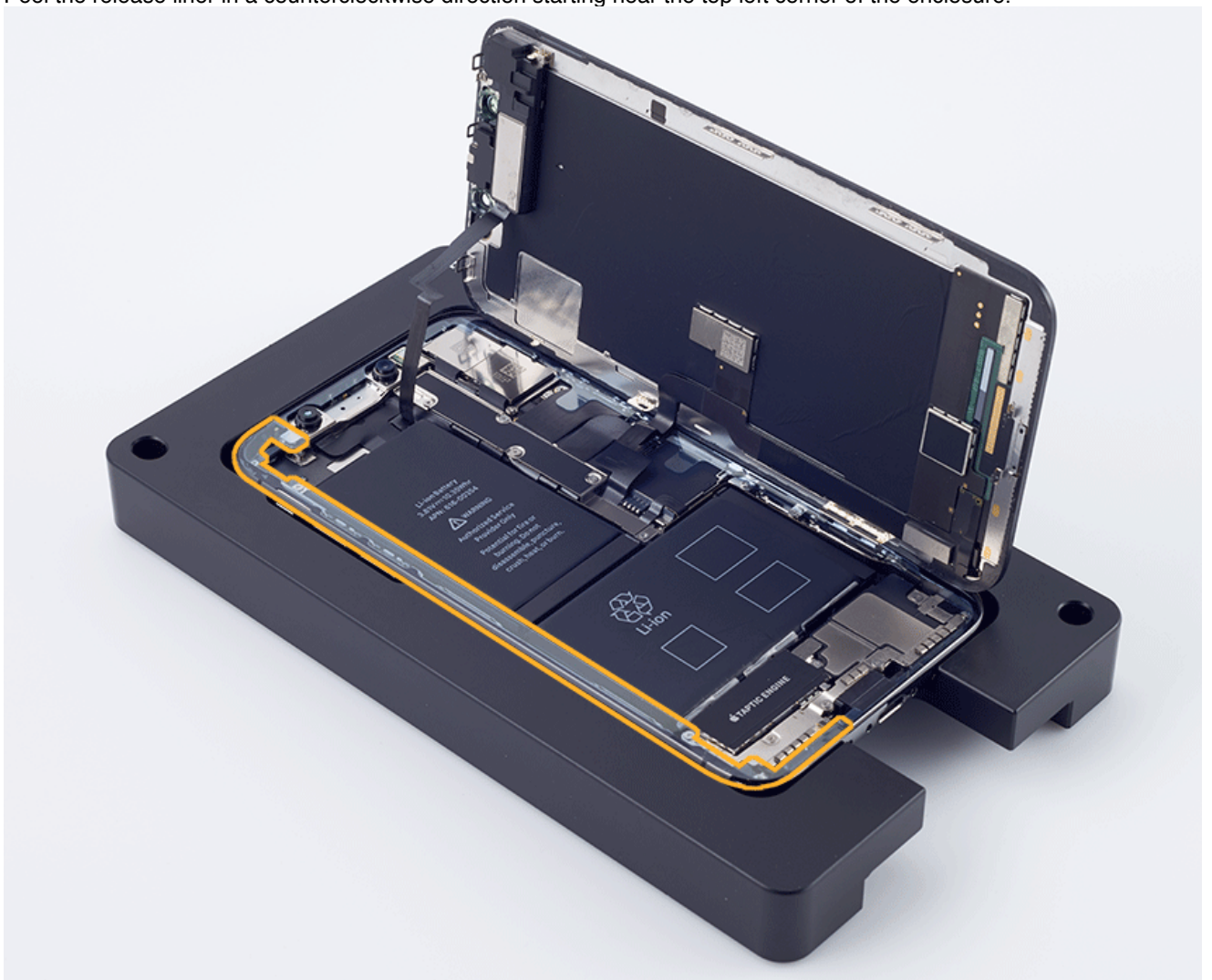


9. Use the iPhone torque driver (black) and MicroStix bit to install five **new** trilobe screws into the upper cowling.
  - 923-01971, left
  - 923-01972, top left, top right, right
  - 923-01973, middle





10. Peel the release liner in a counterclockwise direction starting near the top left corner of the enclosure.



11. Peel the release liner in a counterclockwise direction starting near the bottom of the camera.



12. Peel the release liner in a clockwise direction starting near the display flexes.





13. Inspect the display adhesive to make sure it is in the correct position and not damaged or wrinkled.
14. Release the suction cups from the display. Tip the display to the left.



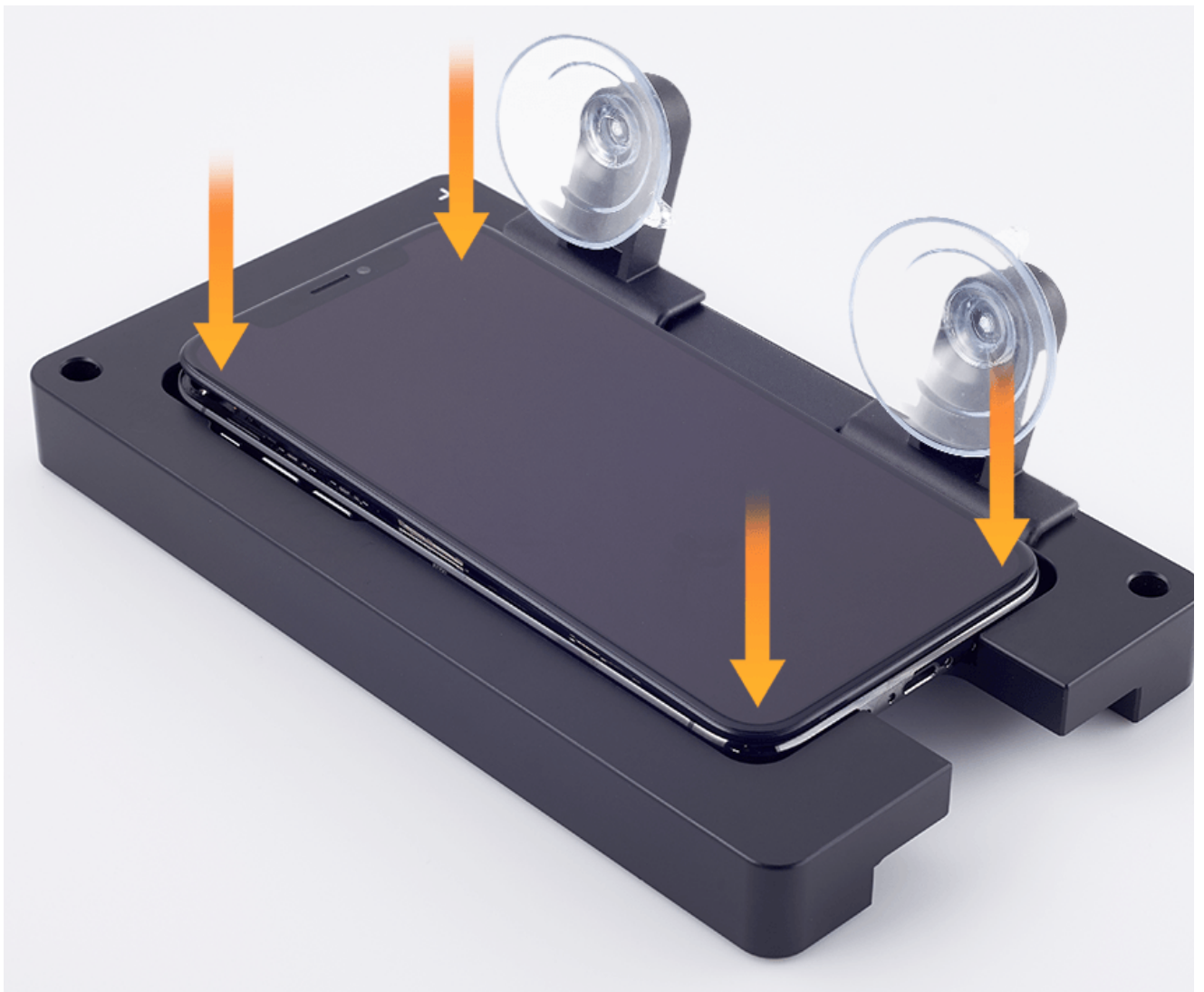
**Warning:** If the battery is dented, punctured, swollen, or otherwise damaged, then **stop the repair**. Do not remove the battery from the device. Reassemble and replace the whole unit.

Refer to articles [TP328: iPhone Safety](#) and [HT204762: Enclosure separation due to expanded battery](#).



15. Press all corners of the display simultaneously and then press along the edges of the display until an audible click is heard and the display is flush with the enclosure. **Important:** Ensure the display flexes are not trapped between the display and enclosure.

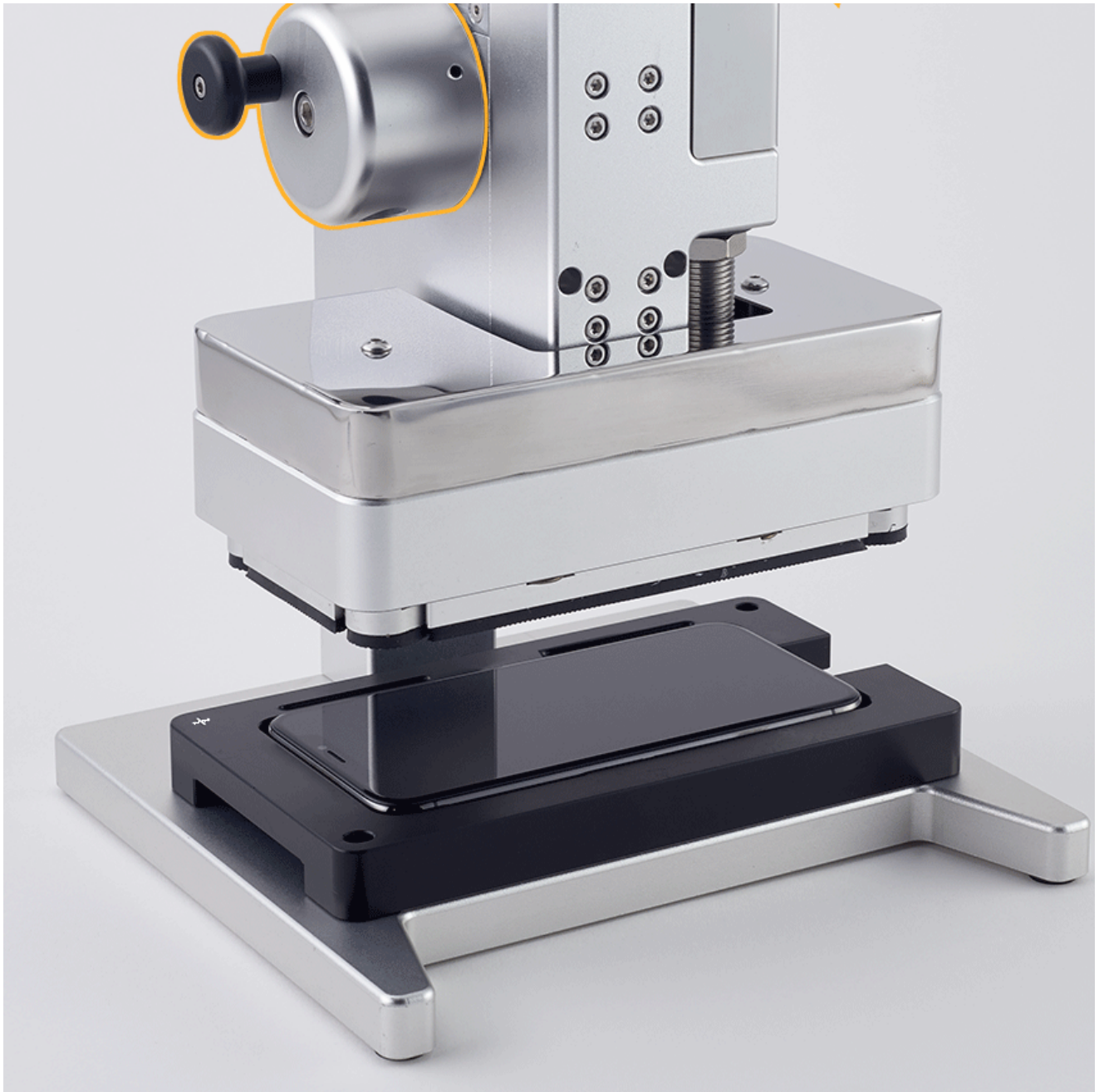




16. Place the iPhone in the Display Press and pull the lever down until the press locks.

**Important:** Use the Display Press to ensure a proper seal and 3D Touch functionality. Display calibration may fail if this step is not completed.

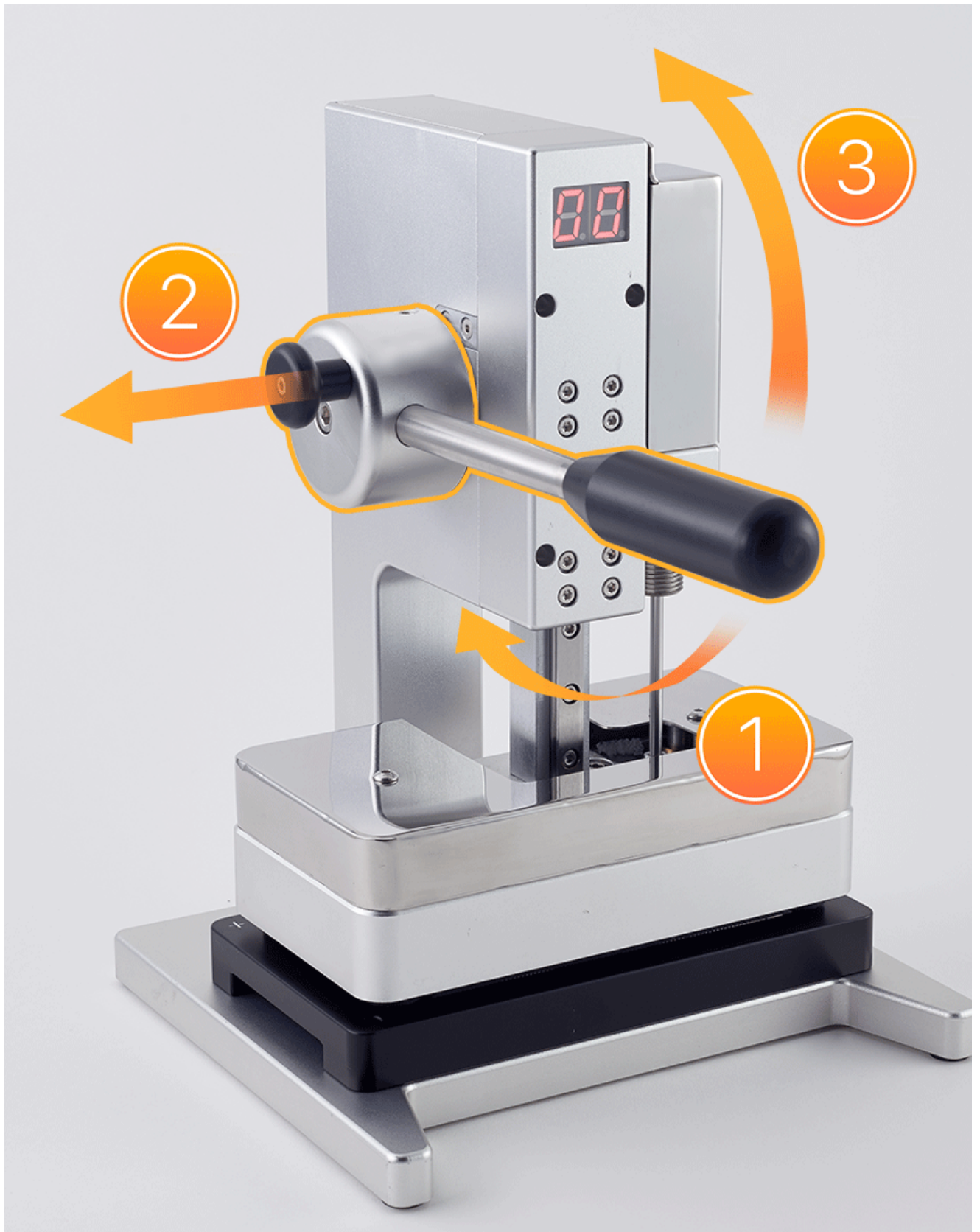




17. Wait until the press timer beeps, then hold the lever down slightly, pull the release knob, and lift the lever up.

**Important:** Use the Display Press to ensure a proper seal and 3D Touch functionality. Display calibration may fail if this step is not completed.





18. Remove the iPhone from the press.
19. Use the iPhone torque driver (blue) and security bit to install two new security screws, one on each side of the Lightning connector. If the screws do not sit flush, then remove the screws, repeat steps 16–18 and install new security screws.
  - 923-01974 (for space gray)
  - 923-01950 (for silver)



20. **Important:** Check iPhone operation using the steps in article [TP1045: Functional Test](#).

# Replace Display Assembly

## First Steps

- This procedure should only be performed by Apple-certified technicians at authorized locations that have a 3D Touch Calibration Fixture.
- Refer to the [Visual/Mechanical Inspection \(VMI\) Guide](#) to determine whether any accidental damage is present.
- Remove any cases or screen protectors.
- Follow electrostatic discharge (ESD) precautions.
- Turn off the iPhone.



**Warning:** If the enclosure is separated due to a swollen battery, **stop the repair**. Do not remove the battery from the device. Replace the whole unit. Refer to articles [TP328: iPhone Safety](#) and [HT204762: Enclosure separation due to expanded battery](#).

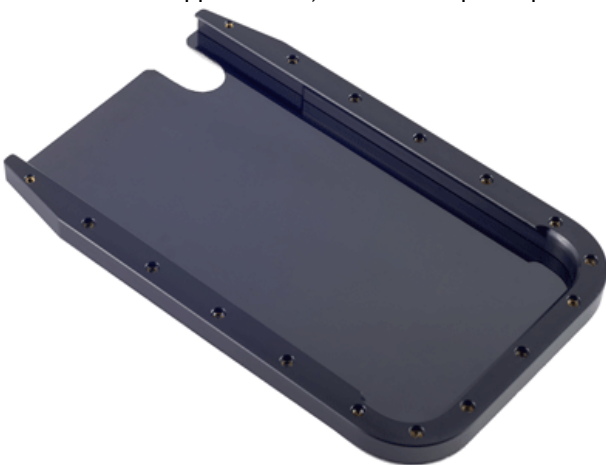
**Warning:** If the display glass is broken, put on safety glasses and material handling gloves. Use a vacuum cleaner to remove any shards present on the workspace or the display. Affix a protective display cover or packing tape before removal to prevent injury or scattering of glass. Do not install the display cover or tape over the edge of the display.

When installing a 5.8-inch Display Protective Cover (923-01921), firmly press the cover onto the broken display to remove air bubbles and work the adhesive into the cracks in the glass. The cover should be left to settle into place longer for more damaged displays, up to 12 minutes, before attempting to remove the display. The longer the protective cover is left on the display, the stronger the bond between the cover and the broken glass.



If the back glass is broken, adhere a 5.8-inch Back Protective Cover (923-02233) before attempting repair. If the protective cover does not adhere to the iPhone or if there is no glass for the film to adhere to, do not attempt a repair. Devices with this type of damage will require a whole unit replacement.

Then place the iPhone in the 5.8-inch support frame (923-01922) before attempting to open the device. If the device does not fit in to the support frame, do not attempt a repair. Devices with this type of damage will require a whole unit replacement.



## Important:

- Display calibration software requires a publicly released version of iOS. For iPhones running beta or SDK versions of iOS, perform a DFU restore before attempting display replacement and calibration.
- Check for iPhone bezel damage that would interfere with proper seating of the display assembly. If the damage is present, replace the whole unit.



For video instruction, search GSX for “Display Replacement and 3D Touch Calibration Video.”



## Tools

- Bar code scanner
- 5.8-inch adapter (923-01912)



## Steps For Removal

[Open Device.](#)



1. \_\_\_\_\_

## Steps For Reassembly

1. Remove all packaging from replacement display.
2. Use a replacement display and follow the reassembly steps in article [RP1397: Open Device](#).
3. Place a speaker port cover (923-02296) over the speaker port prior to calibration. The speaker port cover will reduce the noise generated by the phone during calibration. Calibration without a speaker port cover will not affect the results.



4. Place the iPhone in the 5.8-inch adapter prior to display calibration.



5. **Important:** Display calibration is required after a display assembly replacement. For detailed instructions, search GSX for “3D Touch Calibration Procedure.”
6. **For Retail:** Scan the static KBB (Known Bad Board) serial number or type “OLDSERIALNUMBER” in English when prompted. **Note:** The serial number field is not case-sensitive.



**For AASPs:** Refer to the “Adding Display Parts to GSX” section of article [OP1796: Creating a Carry-In Repair for iPhone display repairs](#).

7. If calibration fails, follow these steps:

If the calibration fails again, then reseal the cables and attempt calibration again in the last used fixture. If reseating does not resolve the issue, replace the whole unit. Note the failure in the repair and process the part as DOA.

**Note for AASPs:** To resolve calibration failures, refer to article [OP1796: Creating a Carry-In Repair for iPhone display repairs](#).

- Follow software prompts
  - Reset the iPhone
  - Attempt display calibration again. **Important:** Use an alternate fixture if available.
8. Remove and discard the speaker port cover.
  9. **Important:** Check iPhone operation using the AST 2 diagnostics suites recommended in article [TP1570: Diagnostics](#)

[Mode](#). If AST 2 is not available, follow the steps in article [TP1045: Functional Test](#).

# 3D Touch Calibration Procedure

This procedure should only be performed by Apple-certified technicians at authorized locations that have a 3D Touch Calibration Fixture.

The 3D Touch Calibration Fixture is intended to calibrate the 3D Touch and the proximity sensor for iPhone 6s, 6s Plus, 7, 7 Plus, 8, 8 Plus, X.

Follow the calibration procedure after an iPhone display replacement.

## Important:

- The 3D Touch calibration software requires that iOS 10 or later is installed on the iPhone. If the device is not running iOS 10 or later, then update the software before performing the repair.
- The 3D Touch calibration software requires a publicly released version of iOS. For iPhones running beta or SDK versions of iOS, perform a Recovery Mode Restore before attempting display replacement and calibration.
- The 3D Touch Calibration Fixture features a door interlock to protect technicians. The interlock will prevent parts from moving so the technician can safely place or pick up the iPhone. Do not bypass or tamper with the door interlock in any way.
- The 3D Touch Calibration Fixture is very sensitive to vibration. Do not do any of the following while calibration is in progress:
  - Place any objects on top of the fixture
  - Move the fixture
  - Touch the fixture
  - Vibrate or shake the bench
  - Play loud music near the fixture
- If the 3D Touch Calibration Fixture has been turned off for an extended period of time, then allow the fixture 15 minutes to warm up before running the calibration.

Refer to article [SV345: Display Replacement and 3D Touch Calibration Video](#) for video instruction.

For fixture setup instructions, technical specifications, and electrical and operating requirements, refer to article [TP1547: 3D Touch Calibration Fixture Setup](#).

## Required Tools

- 3D Touch Calibration Fixture
- Mac mini with 3D TouchCal software

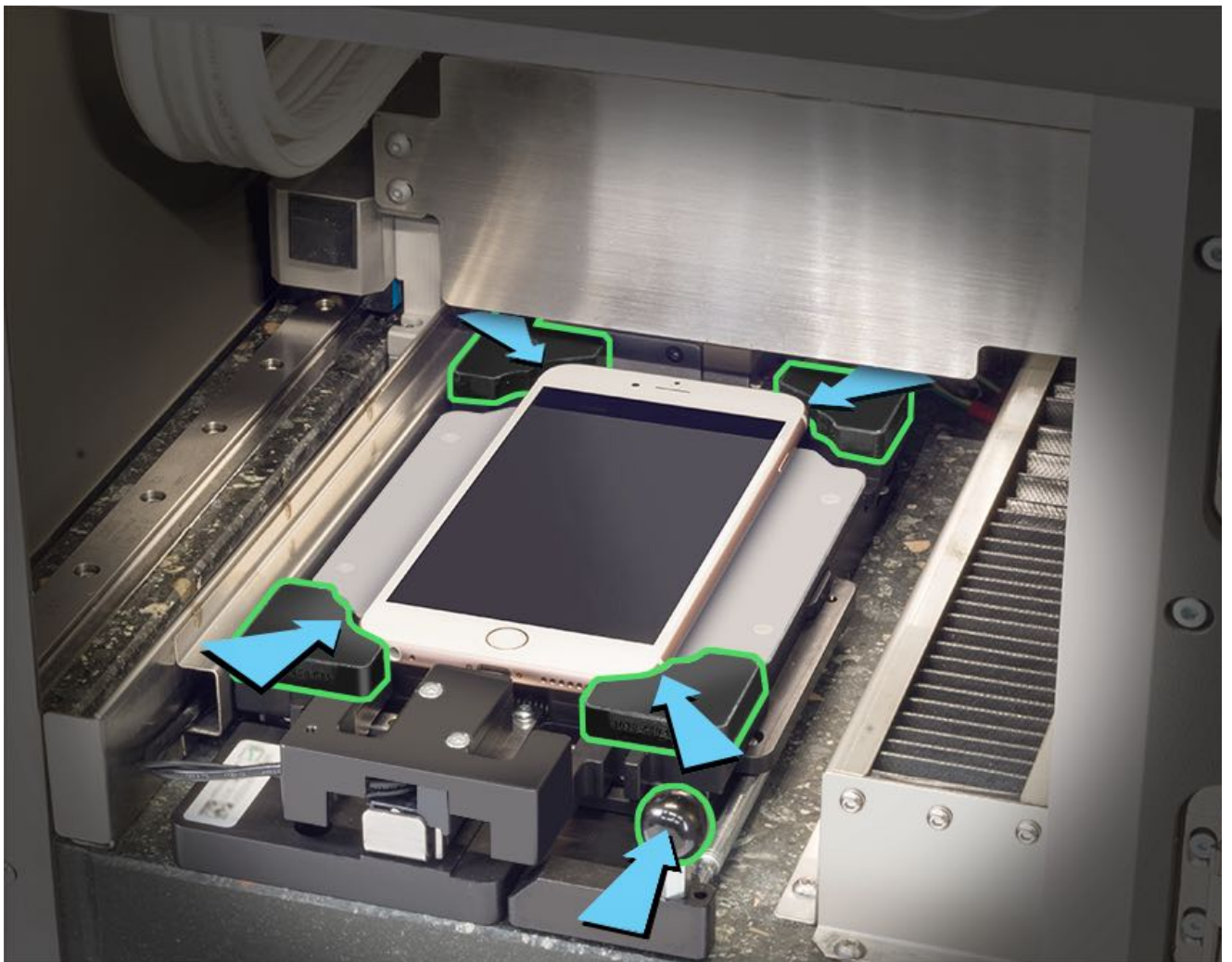
## Prepare iPhone for Calibration

- Make sure the iPhone battery has a charge greater than 20% before attempting to calibrate the device.
- The iPhone must turn on and boot to the lock screen or the home screen before placing the device in the calibration fixture.
- If the device does not boot past the Apple logo, then follow these steps in order:
  - Reset the iPhone.
  - Perform an update or restore using iTunes.
  - If the iPhone is in recovery mode and can not be restored, then perform a whole unit replacement.
- If the iPhone does not turn on, then follow these steps in order:
  - Reset the iPhone.
  - Connect iPhone to a known-good USB charger.
  - Open device and reseal battery connector and display connectors.

**Important:** An iPhone that turns on but has a blank black screen will fail calibration. If a display replacement did not resolve the issue, then follow the troubleshooting steps for the original issue.

## Calibration Procedure

1. Verify the following before beginning the calibration procedure:
  - The calibration fixture is turned on.
  - The iPhone has at least 20 percent battery charge.
2. Verify that the calibration fixture door is clear of any obstructions. Close the 3D Touch Calibration Fixture door.
3. Launch the 3D TouchCal software, located in the Applications folder of the Mac mini. **Note:** If you receive an error, then quit the 3D TouchCal software, turn the fixture off and back on again, restart the computer, and relaunch the software.
4. When prompted, open the door, slide the black handle towards the door opening, and insert the iPhone into the calibration fixture. Align the camera with the cutout on the tray.  
**Important:** Do not open the door until the software prompt appears.
5. Slide the black handle toward the back of the fixture until the iPhone is held firmly in place.

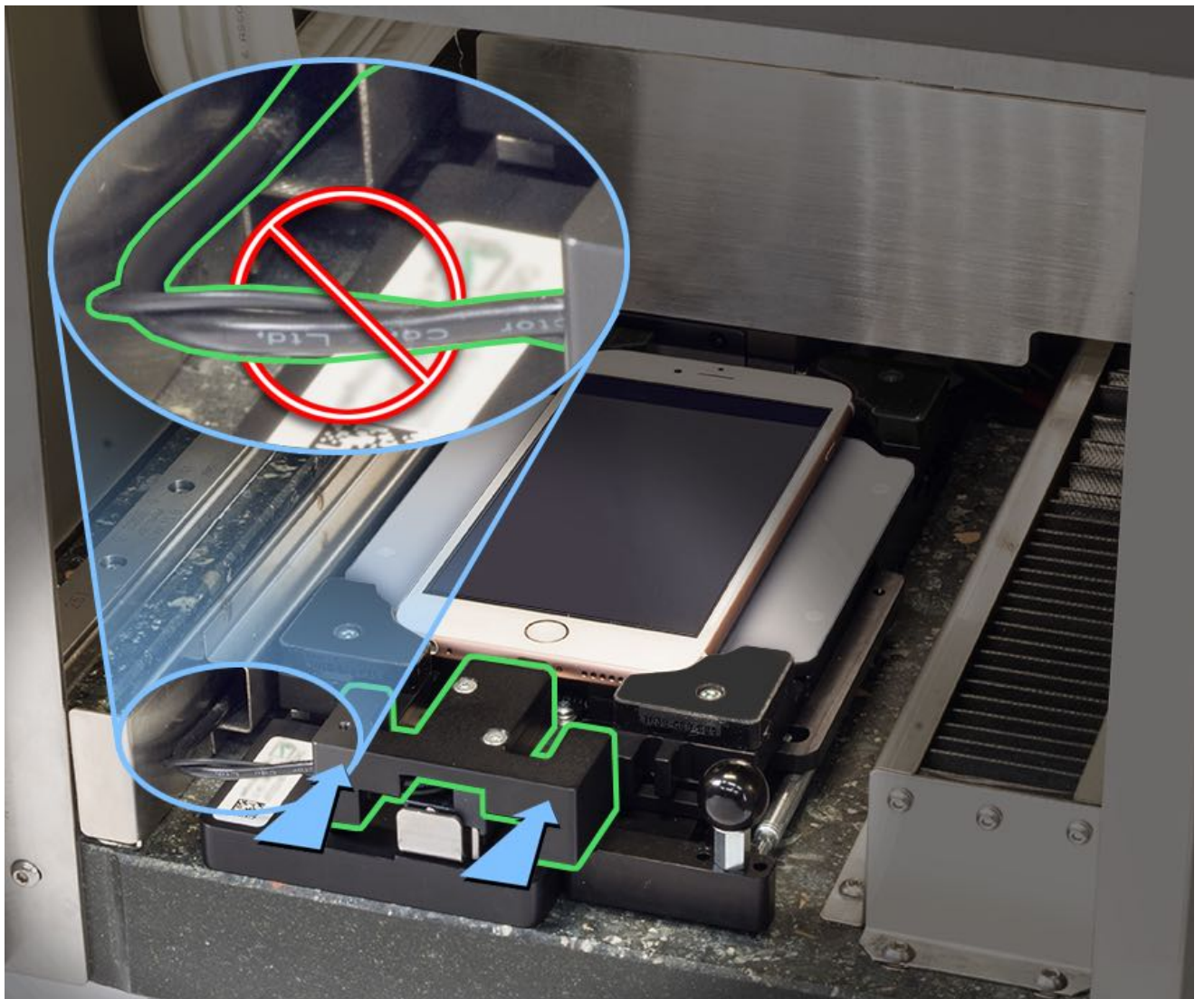


6. Remove the protective film covering from the new display assembly.  
**Important:** Do not touch the display after cleaning. Finger oils cause test anomalies.



7. Slide the connector carrier to plug in the USB to Lightning device under test (DUT) cable. **Important:** Do not use the cable on the left side of the carrier to plug in the Lightning connector. Using this cable will damage the fixture.

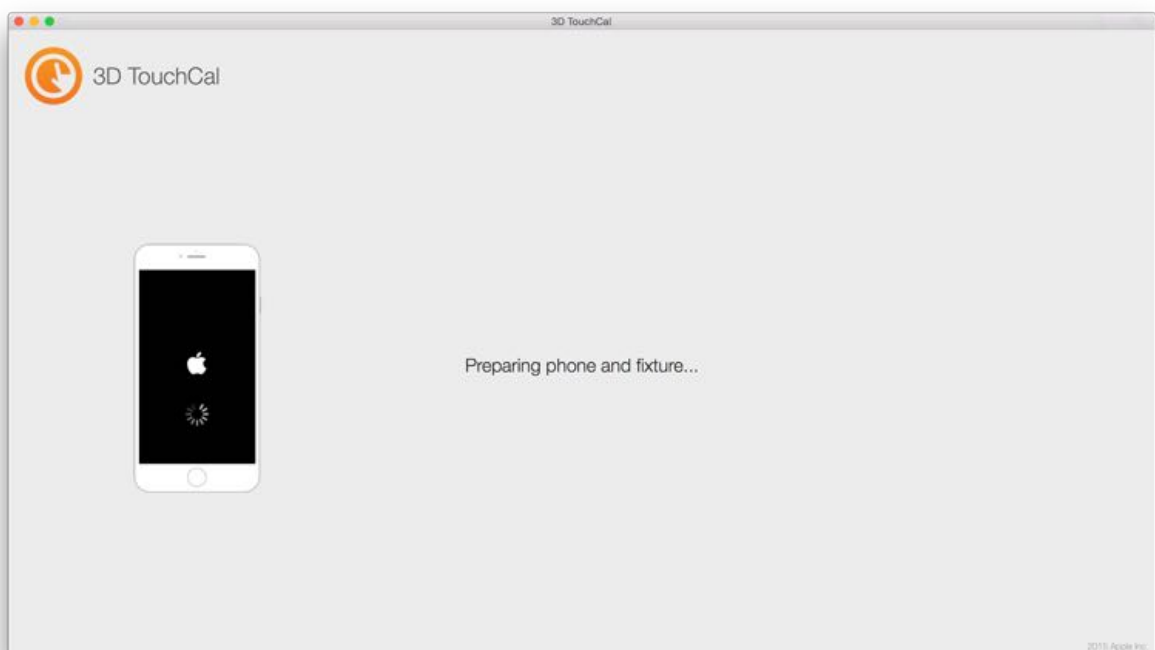




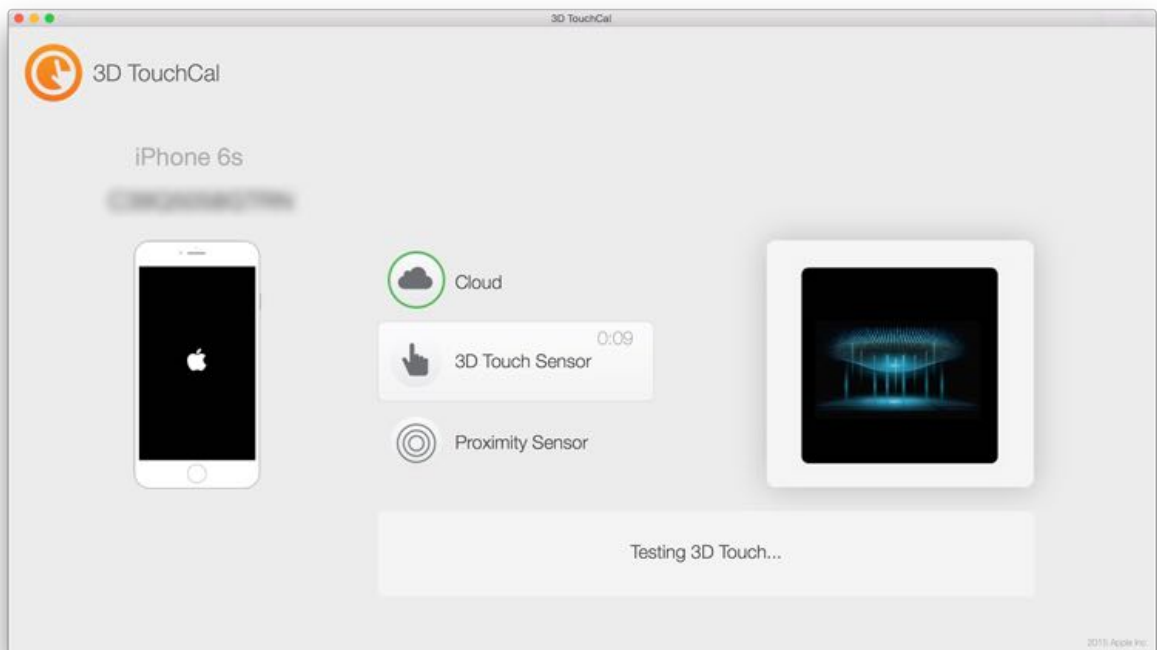
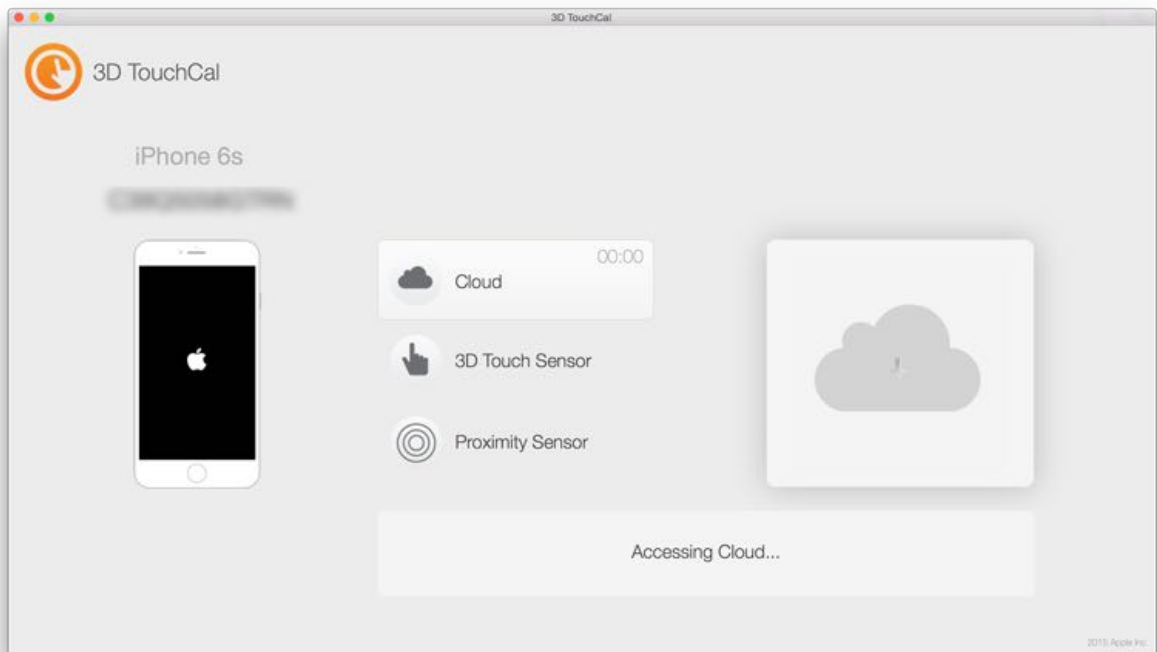
8. Verify that the calibration fixture door is clear of any obstructions. Close the 3D Touch Calibration Fixture door.



**Warning:** Do not attempt to open the door during testing. The 3D Touch Calibration Fixture contains moving parts.

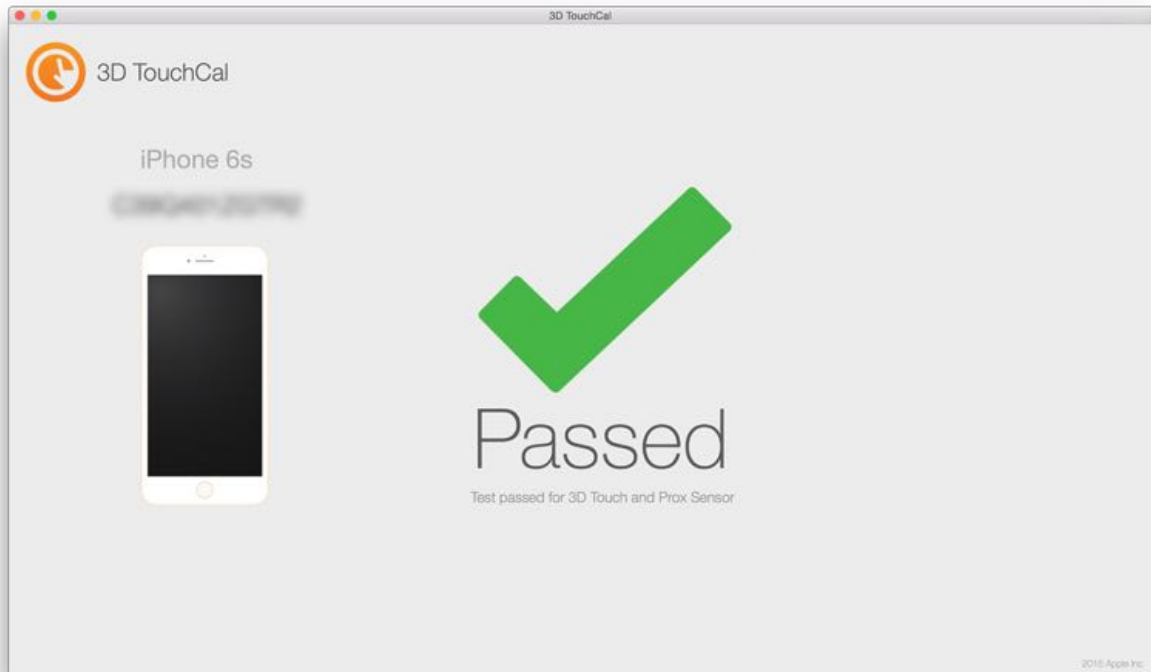


**Note:** Display calibration will take approximately 12 minutes. If calibration fails, then run the calibration again by repeating steps 3 through 10.



9. When calibration is complete, wait for the Apple logo to appear on the display of the calibrated iPhone before opening the door to remove the iPhone from the fixture.

**Note:** If the Apple logo does not appear, then run the calibration process again by repeating steps 3 through 10.



10. Slide the connector carrier to unplug the USB to Lightning device under test cable. **Important:** Do not use the cable on the left side of the carrier to unplug the Lightning connector. Using this cable will damage the fixture.
11. Slide the black handle toward the door opening and remove the iPhone from the calibration fixture.
12. Interpret the calibration results:
  - **PASS:** If calibration passes, then perform all functional tests in article [TP1045: Functional Test](#).
  - **FAIL:** If calibration fails, follow these steps:
    - Follow software prompts.
    - Reset the iPhone. **Note:** The phone may be in recovery mode. This is expected. Attempt calibration again with the phone in recovery mode.
    - Attempt display calibration again. **Important:** Use an alternate fixture if available.



If the calibration fails again, then reseal the cables and attempt calibration again in the last used fixture. Clean the iPhone display with a lint-free cloth before attempting calibration.

If reseating does not resolve the issue, replace the whole unit. Note the failure in the repair and process the part as DOA.

If the 3D Touch Calibration Fixture fails to function, refer to article [TP1571: Troubleshooting the 3D Touch Calibration Fixture](#).

For fixture setup instructions, technical specifications, and electrical and operating requirements, refer to article [TP1547: 3D Touch Calibration Fixture Setup](#).



Label	Definition
	<b>Hand crush hazard</b>
	<b>Electric shock hazard</b>

The EU Declaration of Conformity for this fixture can be found in article [SM264: Declaration of Conformity for Horizon Fixture 661-02459](#).

# Speaker

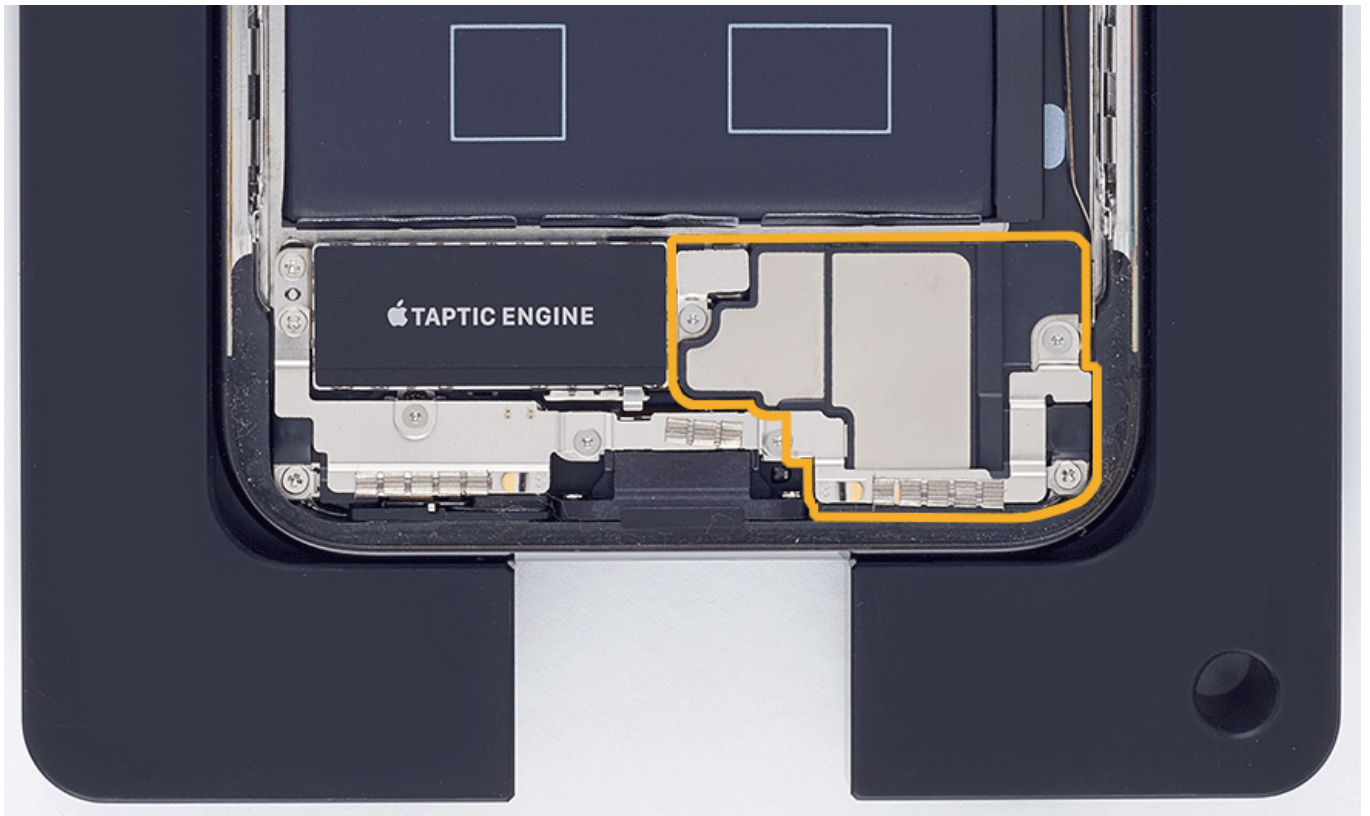
## First Steps

- Perform the [Open Device](#) procedure.

**Important:** This procedure should only be performed by Apple-certified technicians.

The speaker (923-01962) must be replaced if removed from the enclosure.

For video instruction, refer to article [SV363: iPhone X Speaker Replacement Video](#).



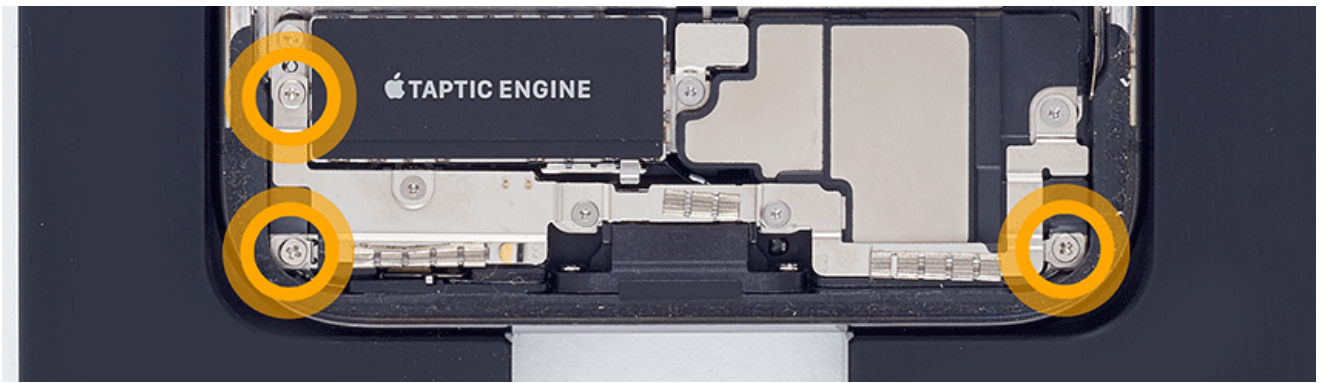
## Tools

1. iPhone torque driver (black) (923-0248)
2. iPhone torque driver (green) (923-00105)
3. iPhone torque driver (gray) (923-00738)
4. JCIS bit (923-0246) for cross-head screws
5. MicroStix bit (923-01290)
6. ESD-safe tweezers
7. Black stick (922-5065)
8. IPA wipes

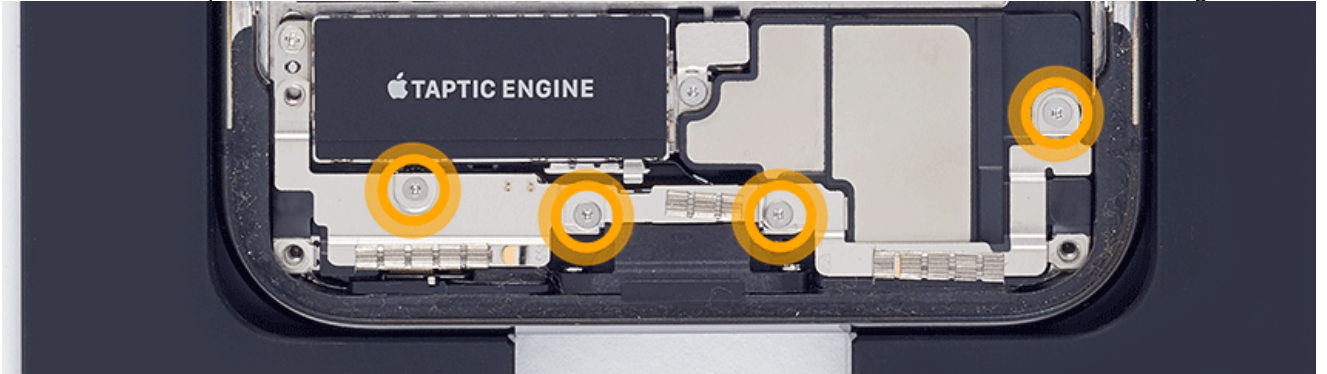


## Steps For Removal

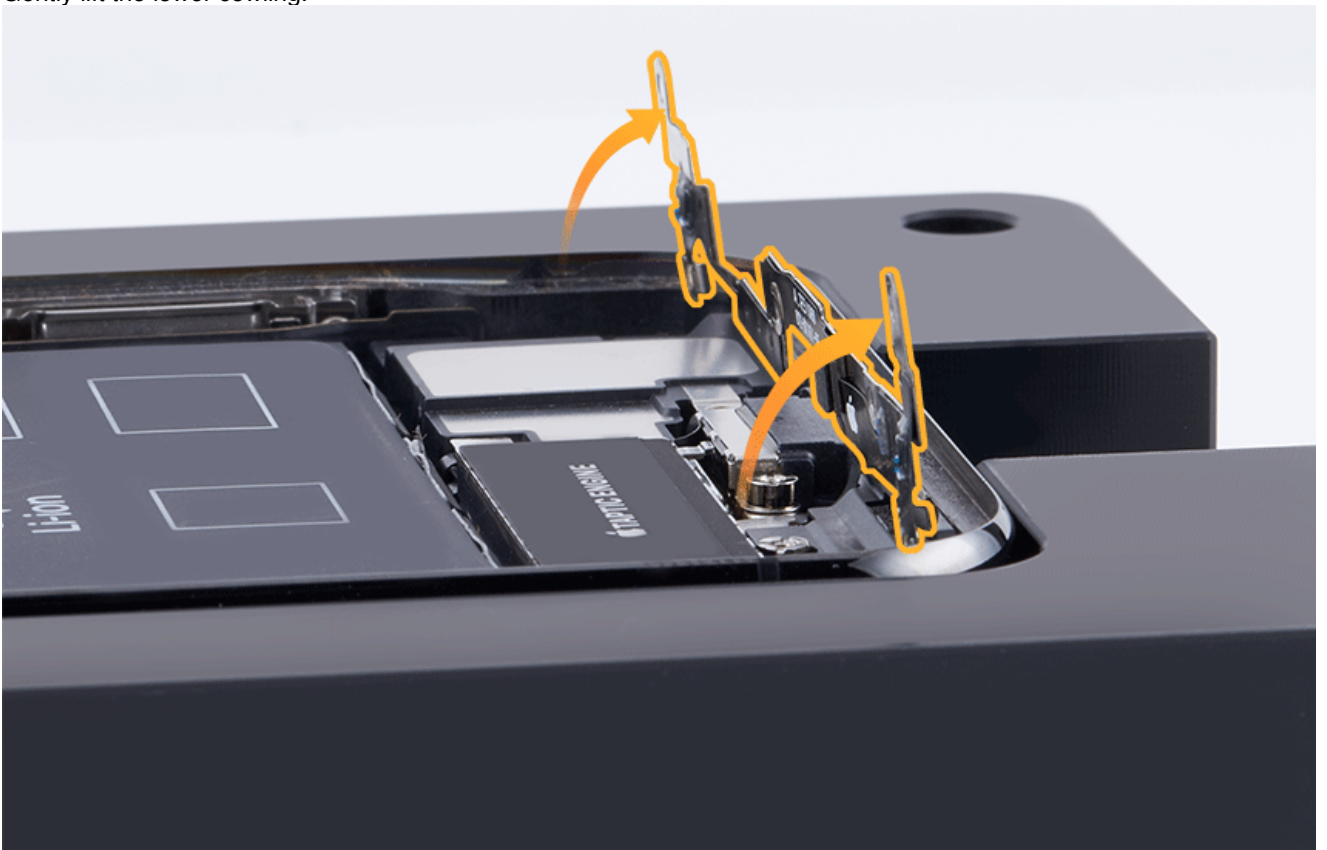
1. Use an iPhone torque driver and JCIS bit to remove and discard three cross-head screws from the lower cowling.



2. Use an iPhone torque driver and MicroStix bit to remove and discard four trilobe screws from the lower cowling.

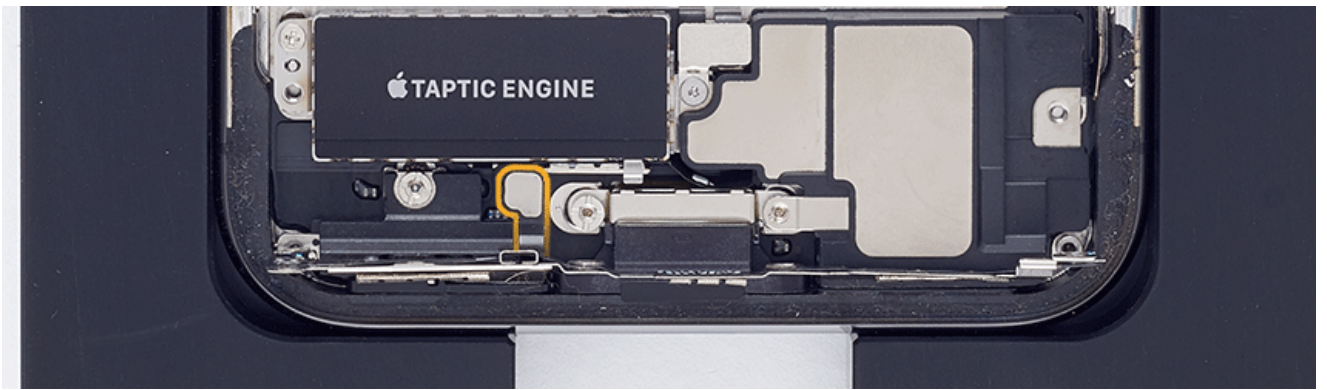


3. Gently lift the lower cowling.

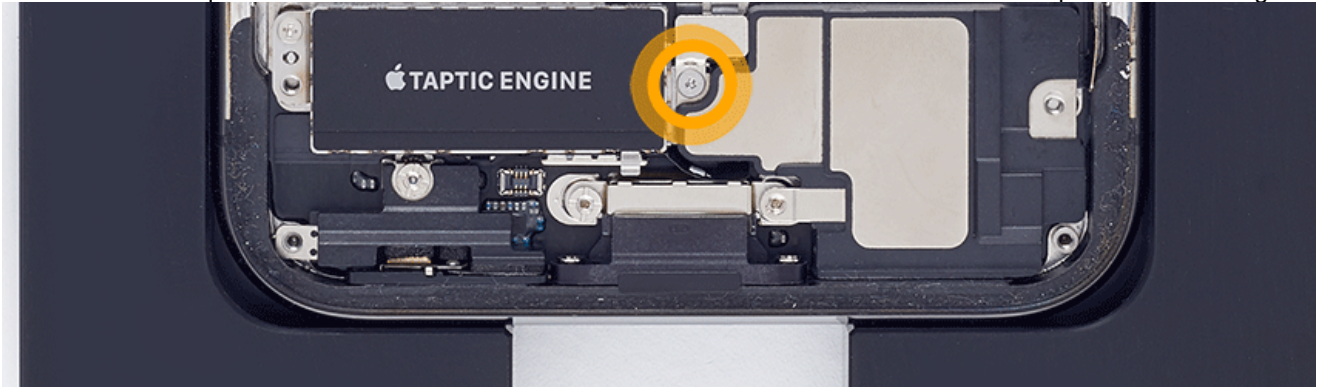


4. Use a black stick to disconnect the lower cowling flex and remove the lower cowling. Save cowling for reuse.

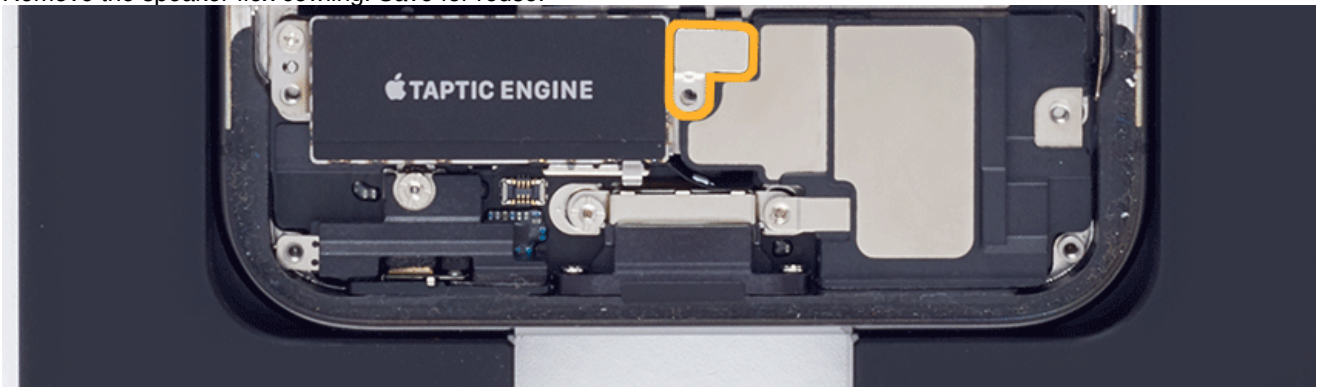




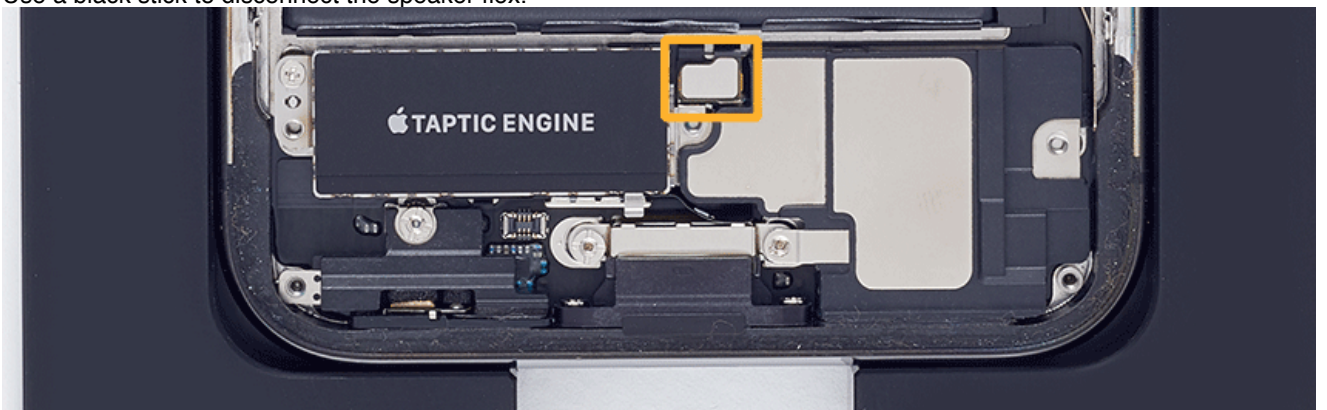
5. Use an iPhone torque driver and MicroStix bit to remove and discard one trilobe screw from the speaker flex cowling.



6. Remove the speaker flex cowling. Save for reuse.

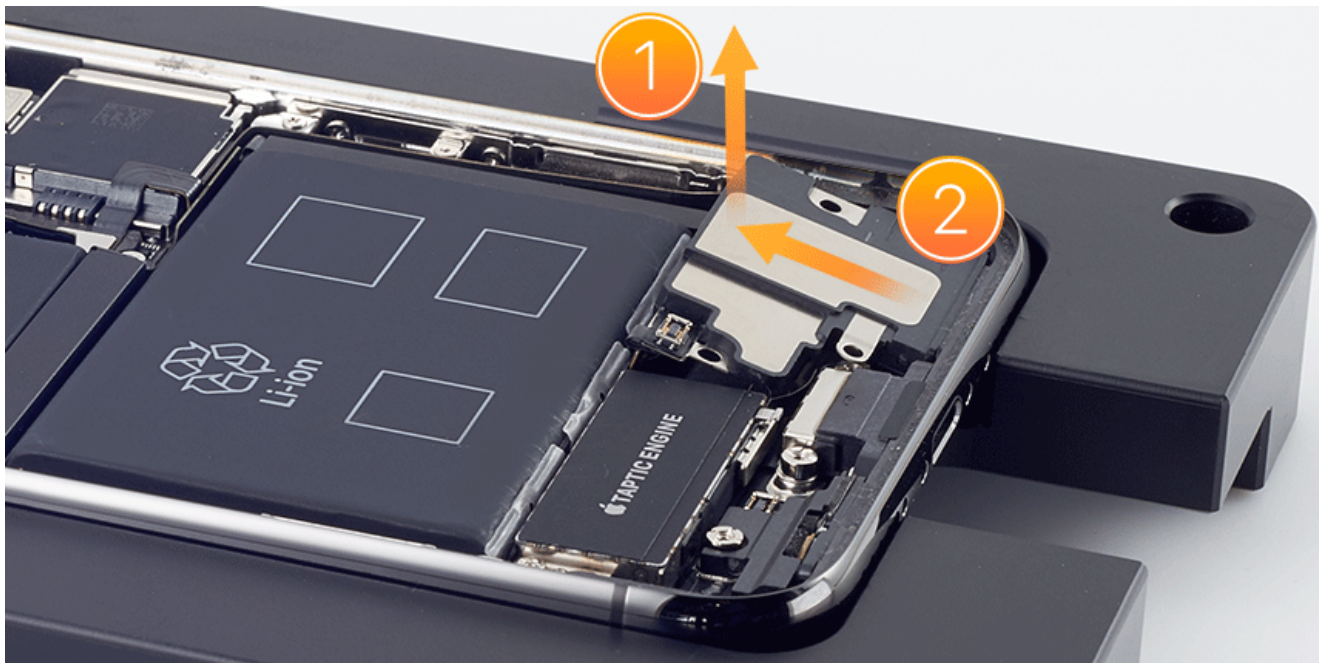


7. Use a black stick to disconnect the speaker flex.

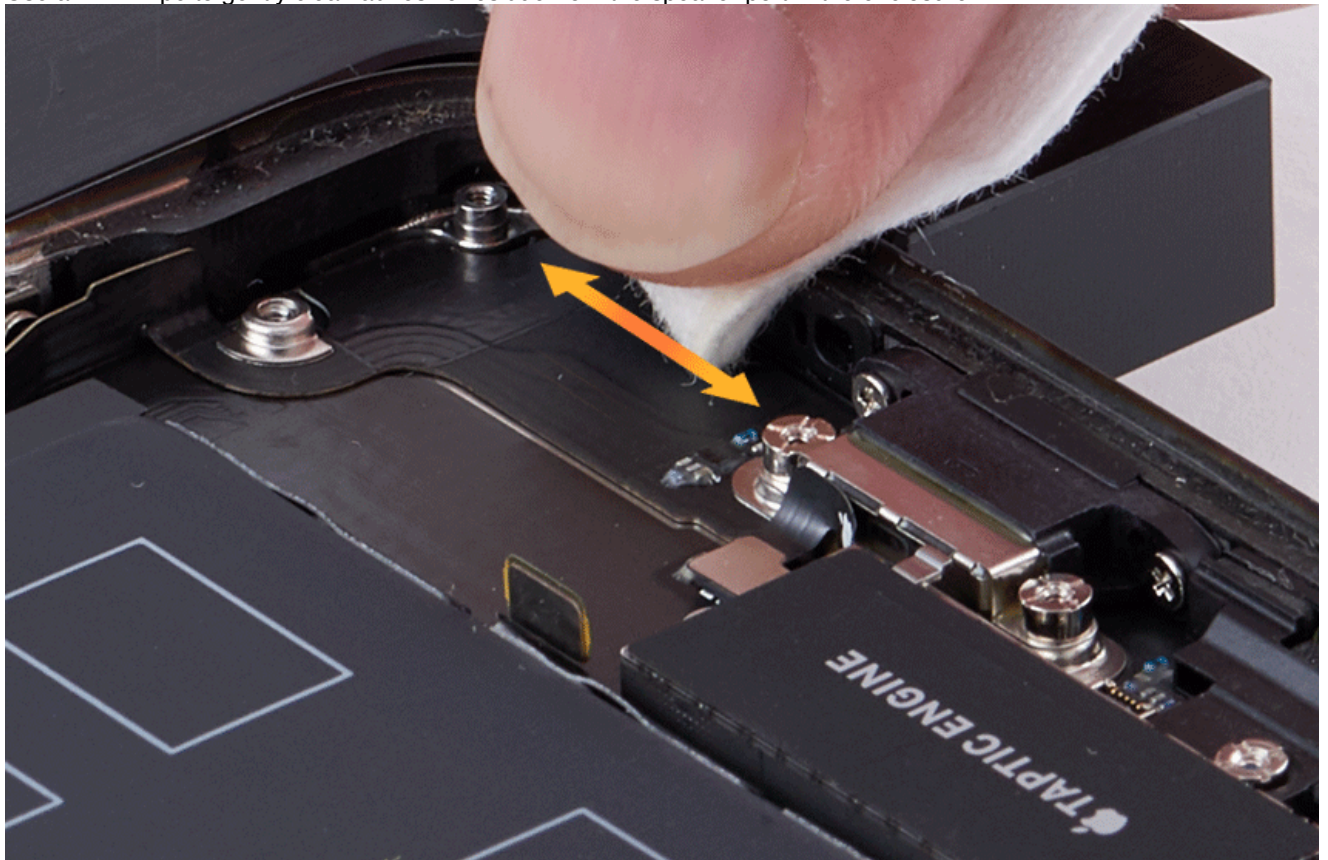


8. Remove the speaker from the enclosure.





9. Use an IPA wipe to gently clean adhesive residue from the speaker port in the enclosure.

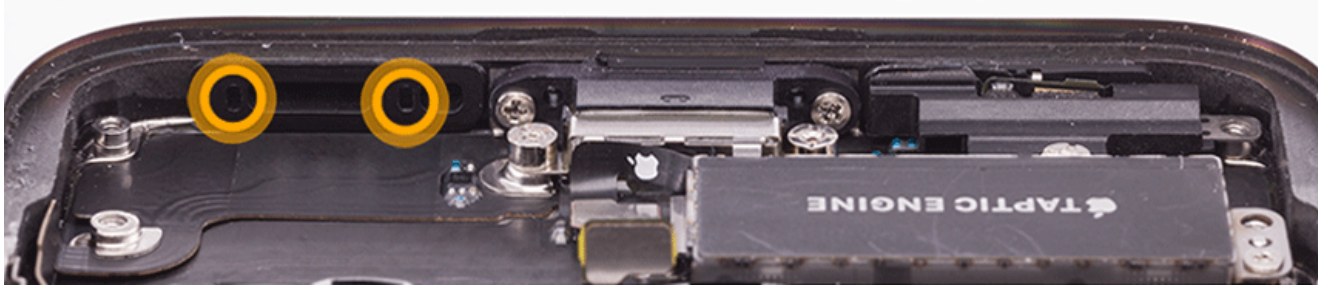
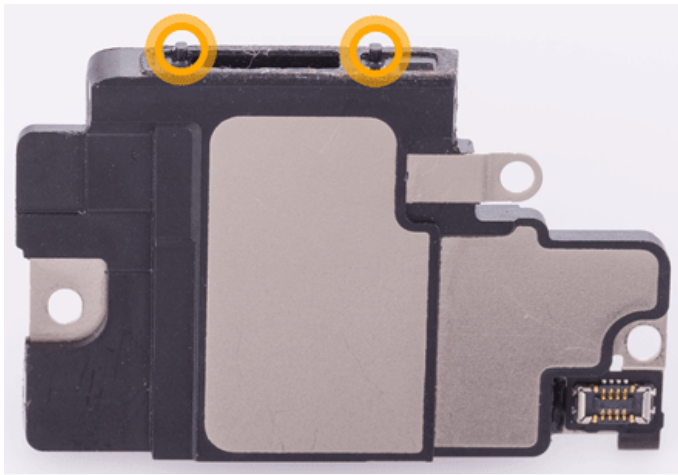


## Steps For Reassembly

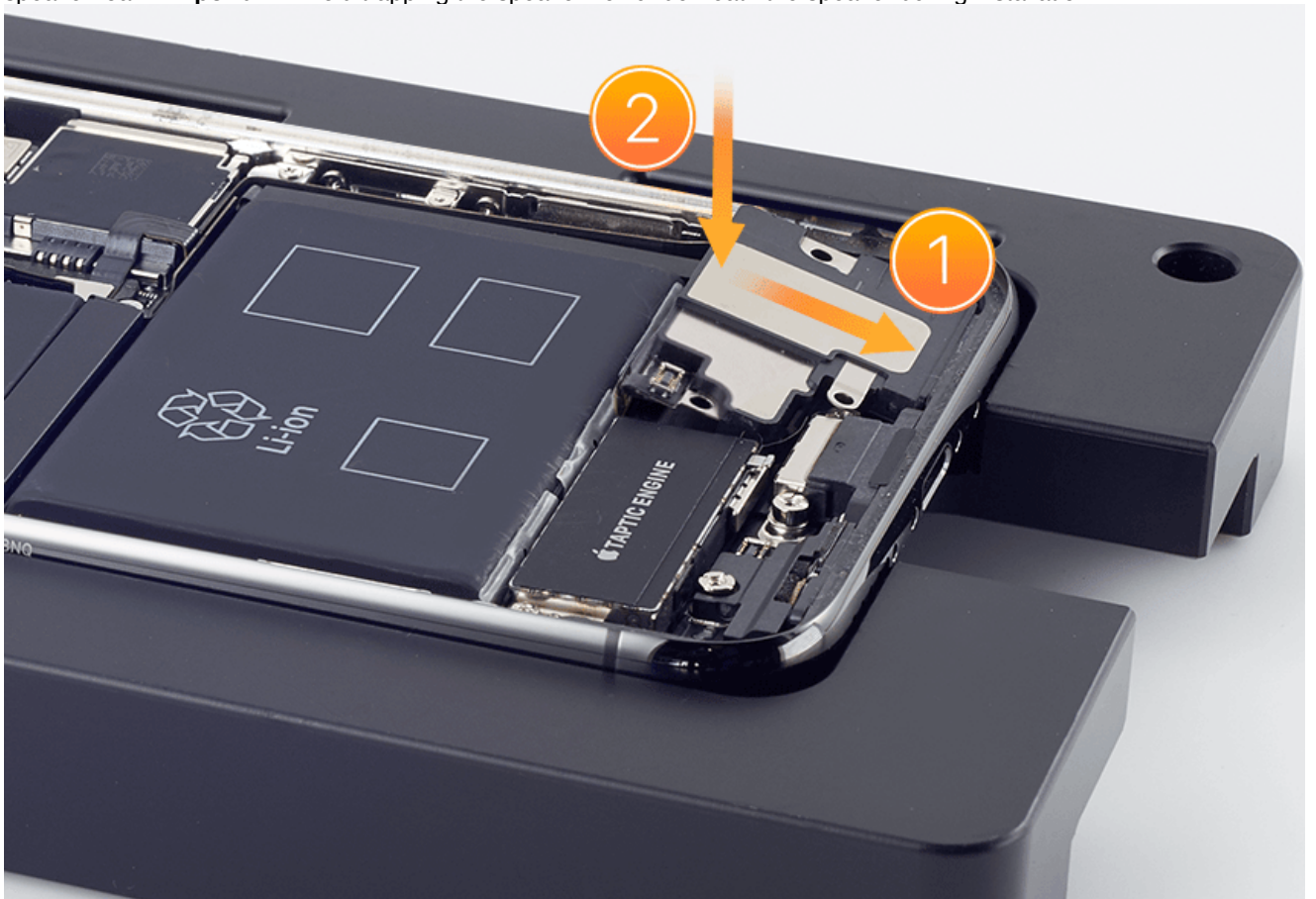
**Important:** Use a new speaker each time a speaker is removed.

1. Remove the liner from the speaker foam gasket.
2. Align the pins on the speaker to the holes in the enclosure.



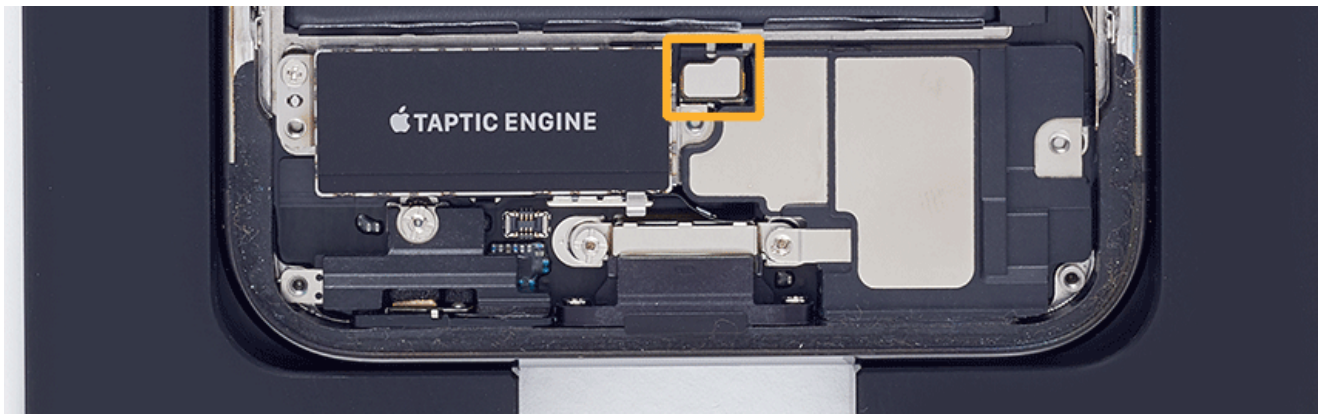


3. Carefully place the speaker into the enclosure. Do not touch the bottom of the enclosure with the adhesive on the speaker foam. **Important:** Avoid trapping the speaker flex underneath the speaker during installation.

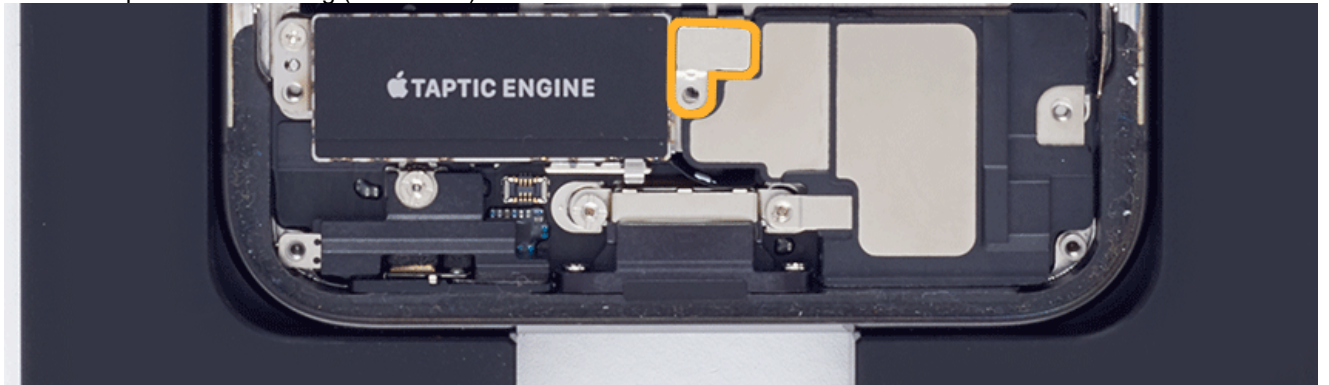


4. Connect the speaker flex to the speaker.

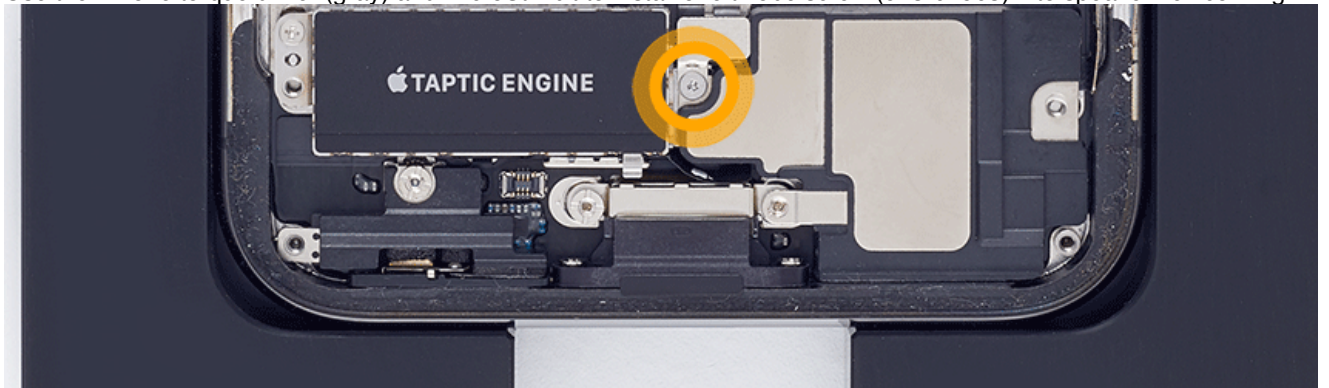




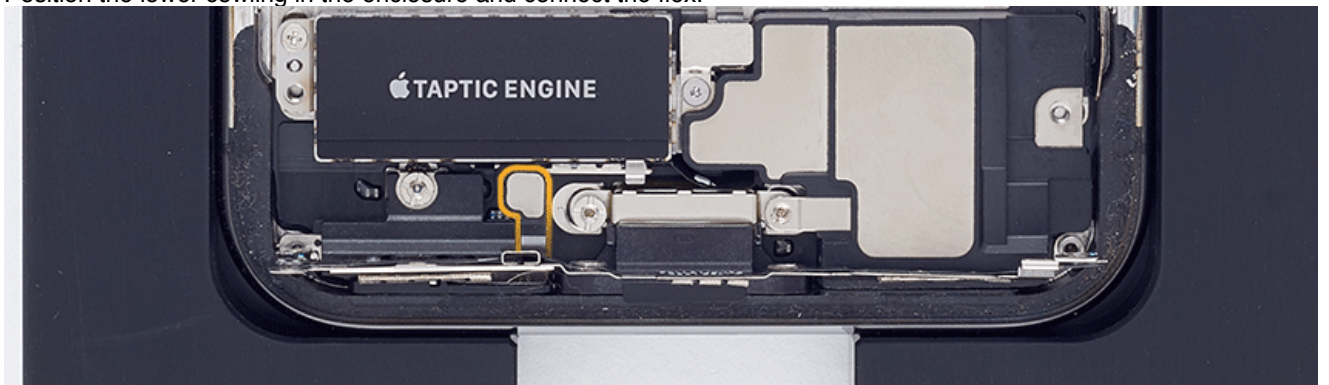
5. Place the speaker flex cowling (923-01968).



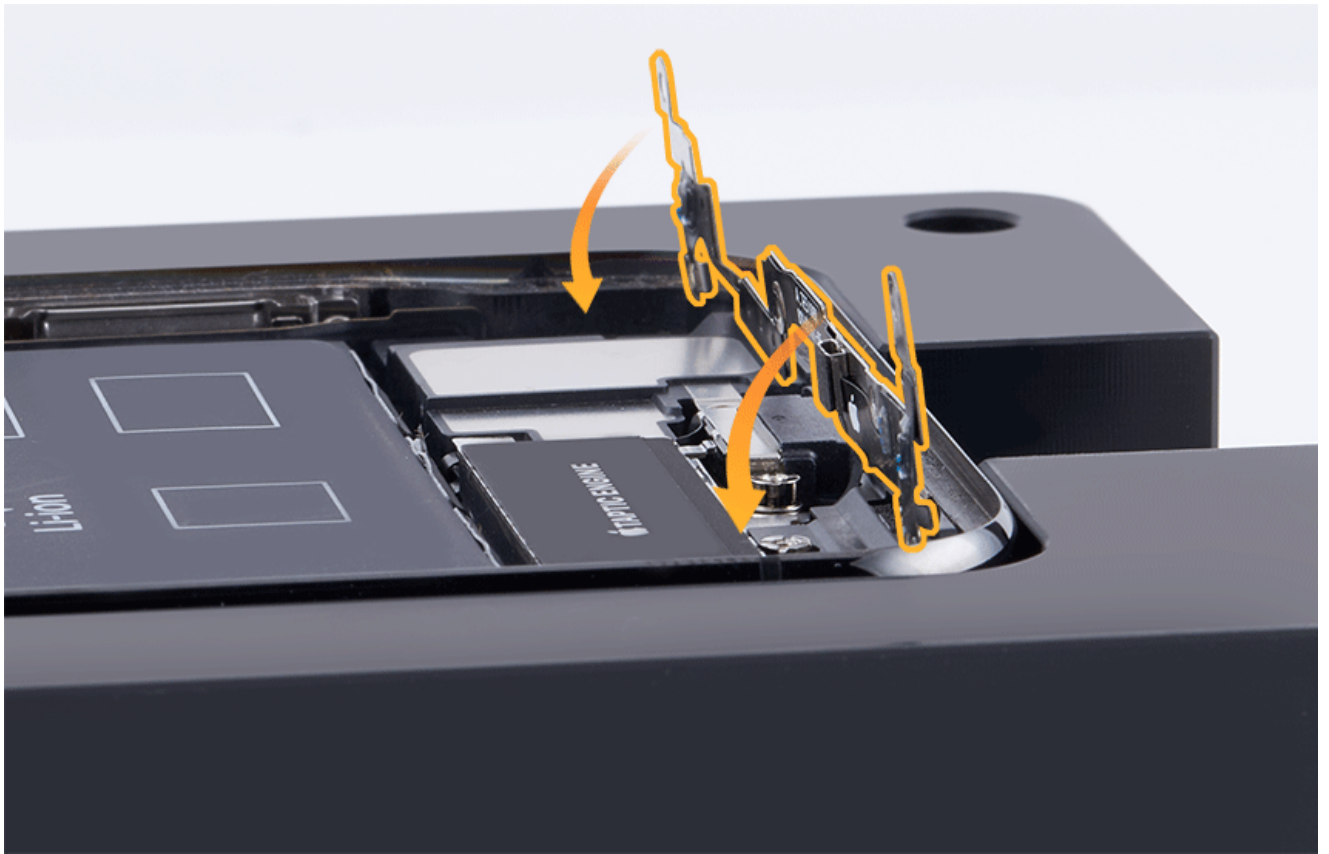
6. Use the iPhone torque driver (gray) and MicroStix bit to install one trilobe screw (923-01963) into speaker flex cowling.



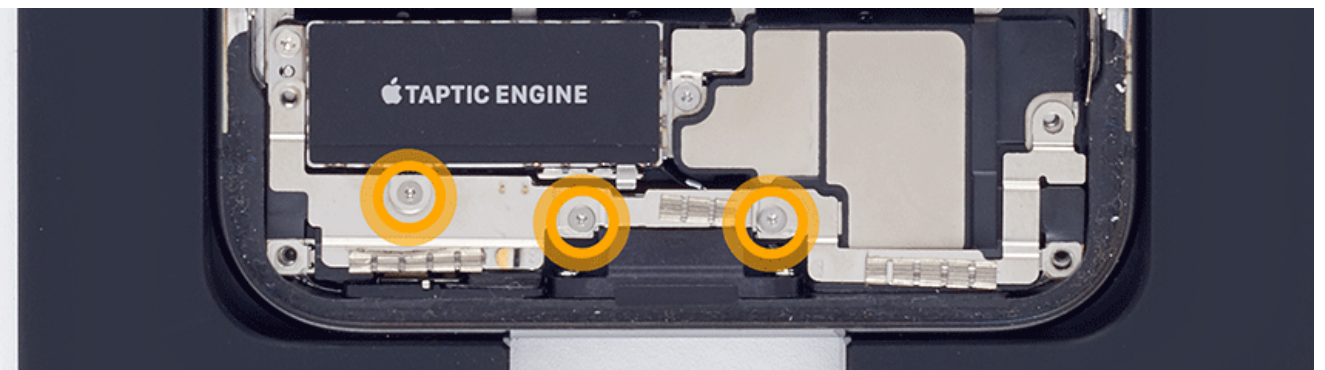
7. Position the lower cowling in the enclosure and connect the flex.



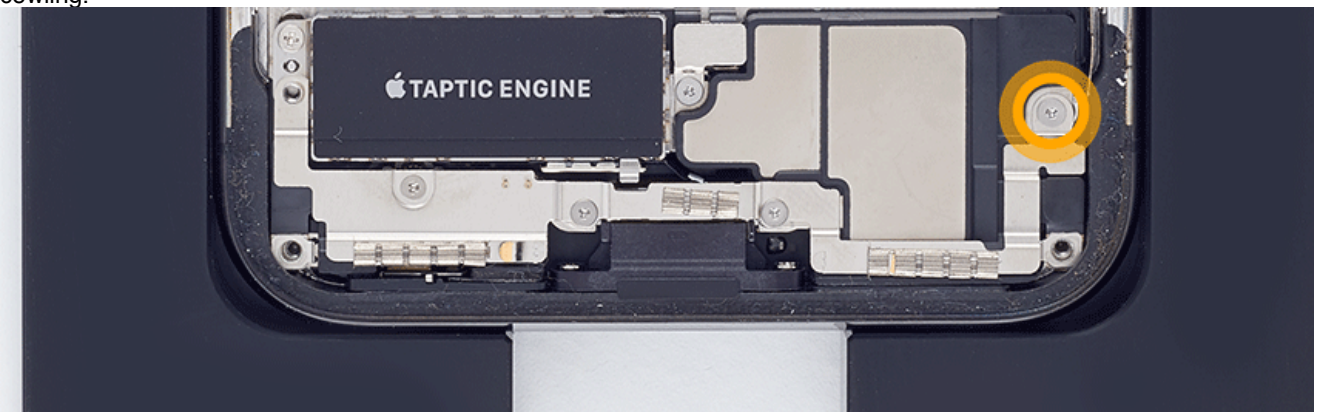
8. Align the lower cowling over the speaker and Taptic Engine. The cowling should be placed slightly under the edge of the enclosure.



9. Use the iPhone torque driver (black) and MicroStix bit to install three trilobe screws to secure the lower cowling.
- 923-01979, left
  - 923-01980, center and right

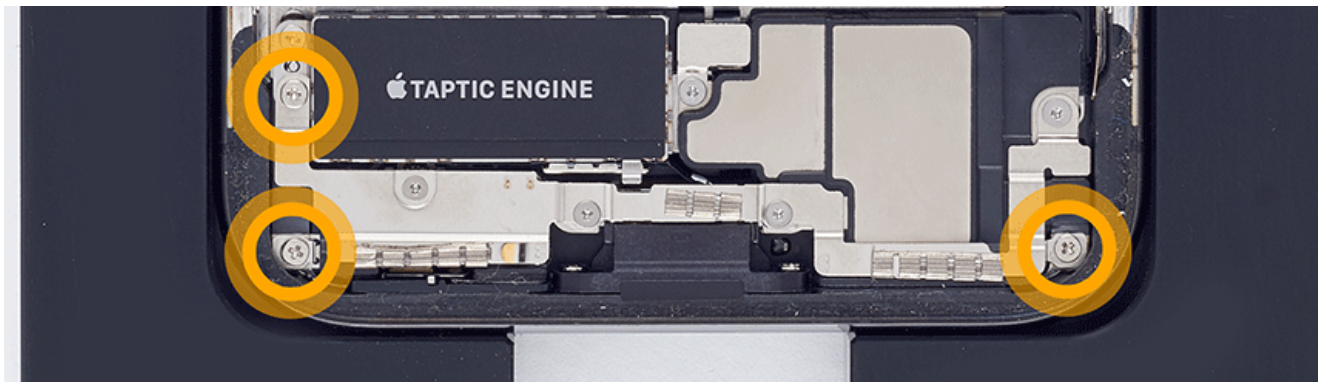


10. Use the iPhone torque driver (gray) and MicroStix bit to install one trilobe screw (923-01964) to secure the lower cowling.



11. Use the iPhone torque driver (green) and JCIS bit to install three cross-head screws to secure the lower cowling.
- 923-01965, top left
  - 923-01978, bottom left
  - 923-01981, right





12. Follow the reassembly steps in article [RP1397: Open Device](#).
13. **Important:** Check iPhone operation using the steps in article [TP1045: Functional Test](#).

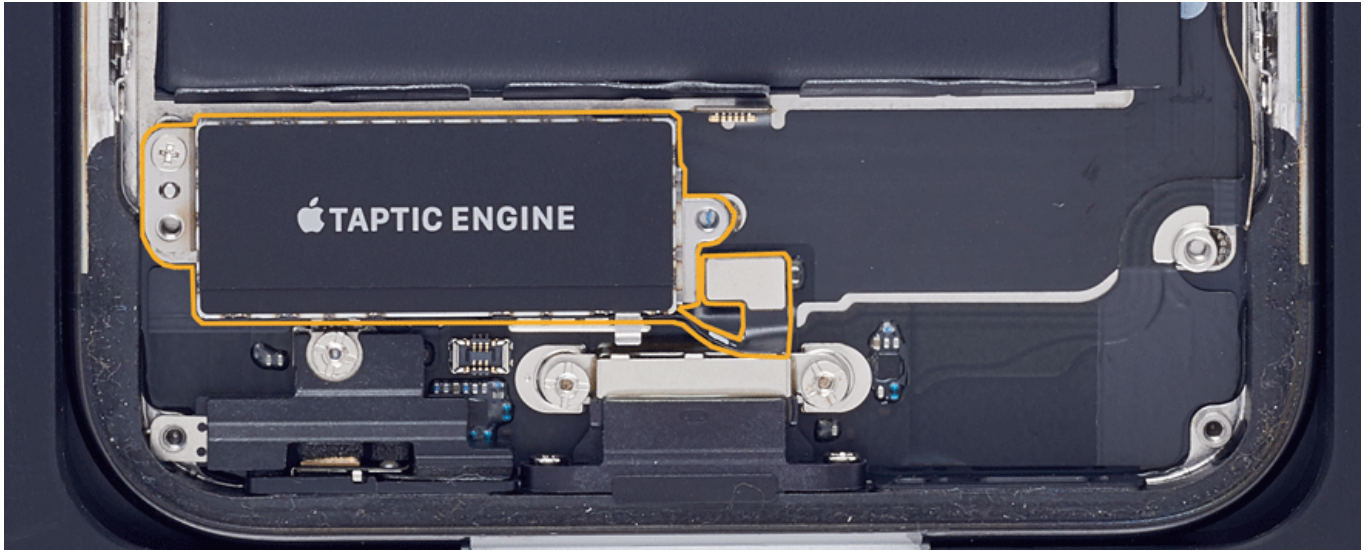
# Taptic Engine

## First Steps

- Perform the [Open Device](#) procedure.
- Remove the [Speaker](#).

**Important:** This procedure should only be performed by Apple-certified technicians.

For video instruction, refer to article [SV362: iPhone X Taptic Engine Replacement Video](#).



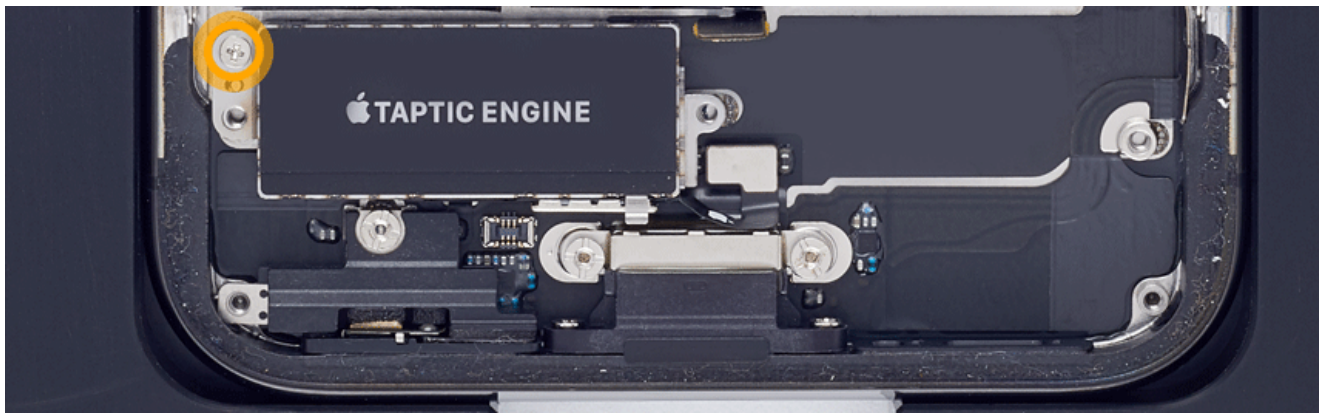
## Tools

1. iPhone torque driver (green) (923-00105)
2. JCIS bit (923-0246) for cross-head screws
3. ESD-safe tweezers
4. Black stick (922-5065)

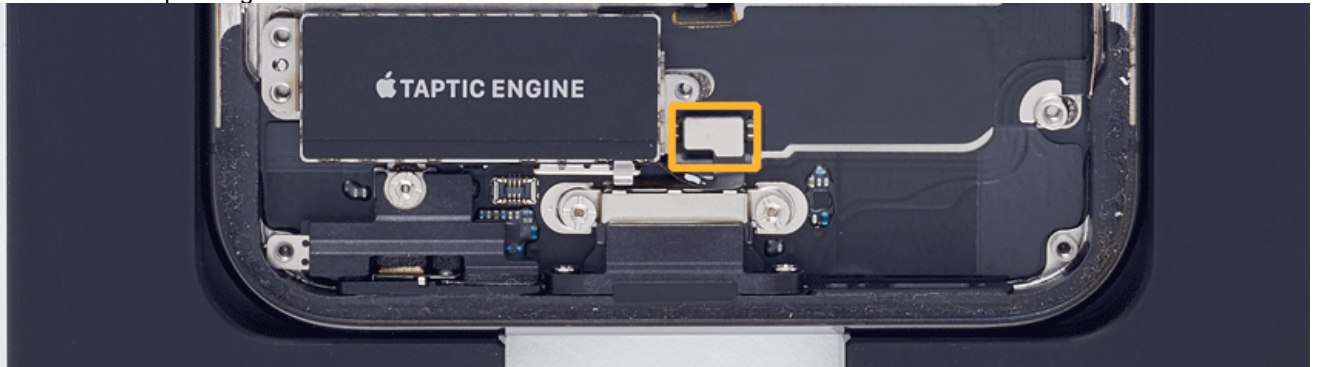


## Steps For Removal

1. Use the iPhone torque driver and JCIS bit to remove and discard one cross-head screw from the Taptic Engine.

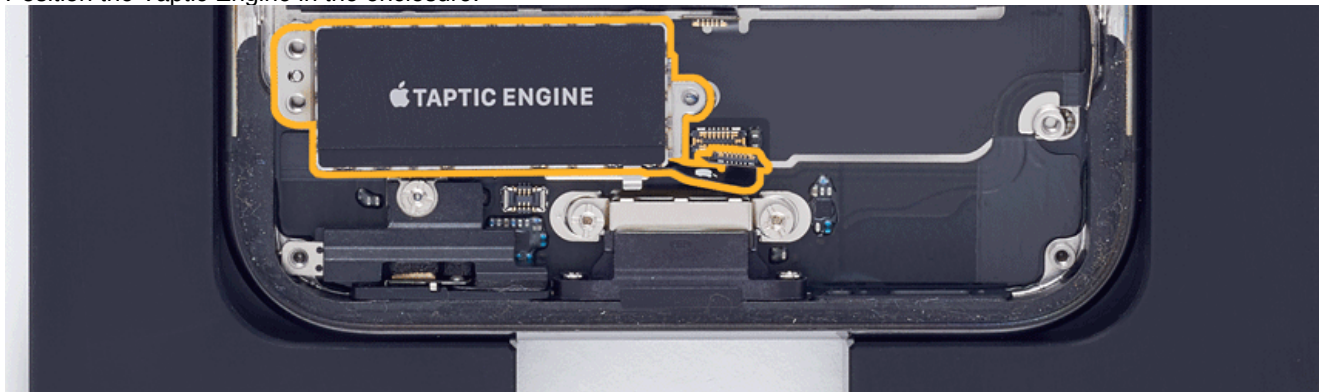


2. Use a black stick to disconnect the Taptic Engine flex.
3. Remove the Taptic Engine.

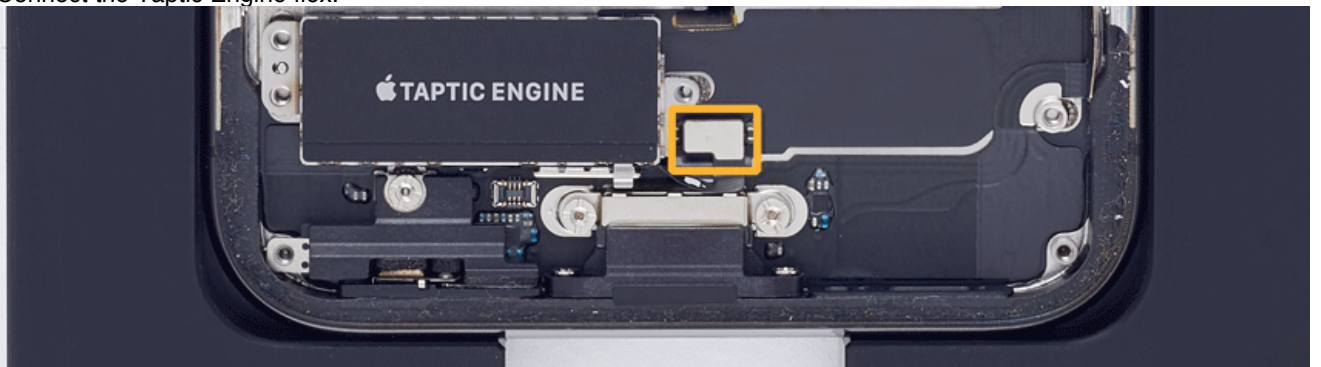


### Steps For Reassembly

1. Position the Taptic Engine in the enclosure.

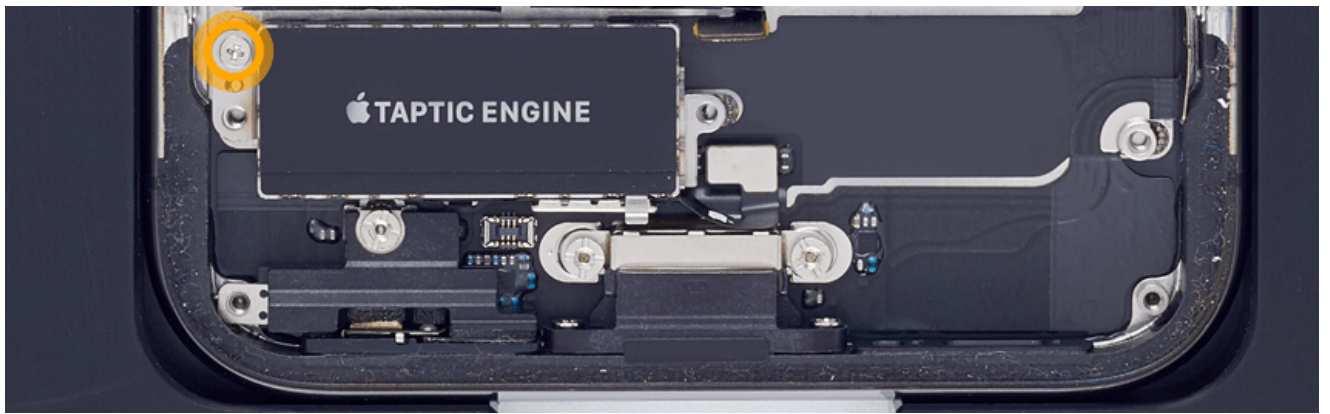


2. Connect the Taptic Engine flex.



3. Use the iPhone torque driver (green) and JCIS bit to install one cross-head screw (923-01965) into the Taptic Engine.





4. Install a new [Speaker](#).
5. Follow the reassembly steps in article [RP1397: Open Device](#).
6. **Important:** Check iPhone operation using the steps in article [TP1045: Functional Test](#).

# Battery

## First Steps

- Review article [TP328: iPhone Safety](#)
- Perform the [Open Device](#) procedure.
- Remove the [Speaker](#).
- Remove the [Taptic Engine](#).

**Important:** This procedure should only be performed by Apple-certified technicians.

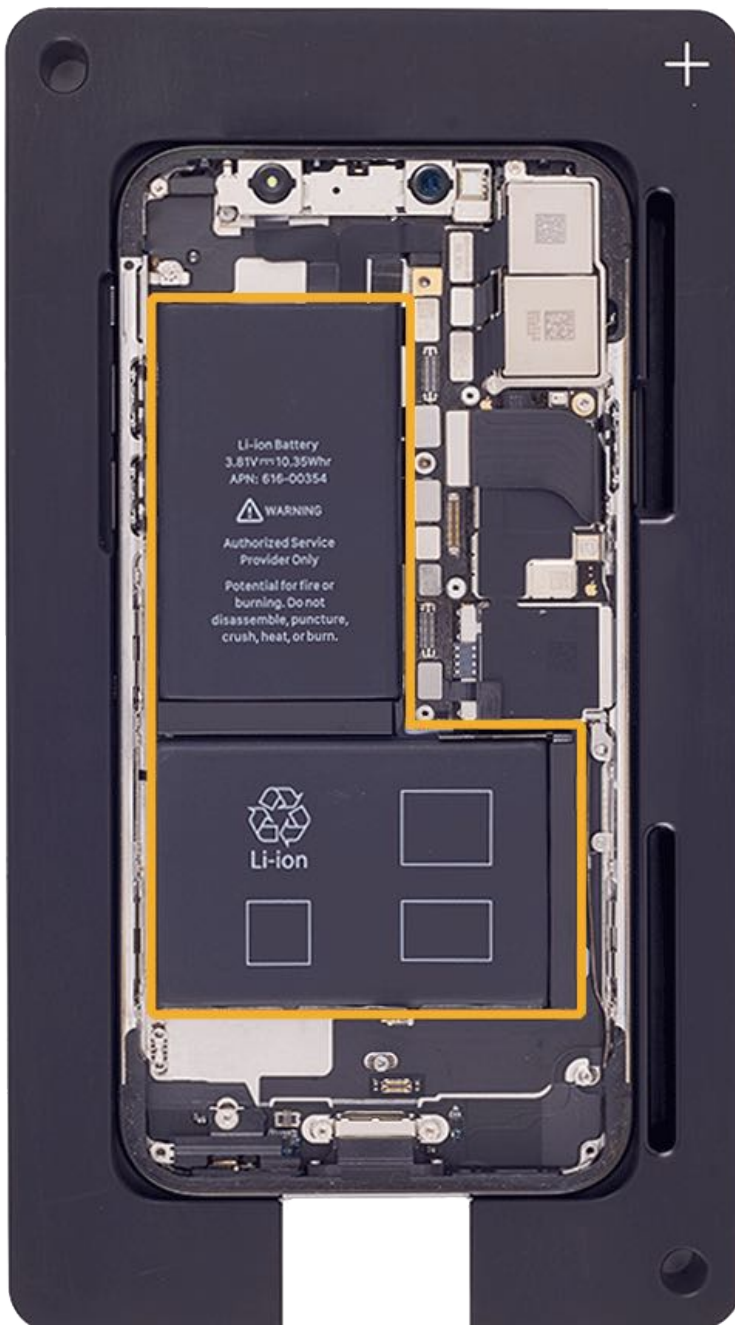


**Warning:** If the battery is dented, punctured, swollen, or otherwise damaged, then **stop the repair**. Do not remove the battery from the device. Reassemble and replace the whole unit.

Refer to articles [TP328: iPhone Safety](#) and [HT204762: Enclosure separation due to expanded battery](#).

**Warning:** Do not reuse or reinstall a loose battery or a battery that has been removed. Replace it with a new battery. If a new battery is unavailable, replace the whole unit.

For video instruction, refer to article [SV360: iPhone X Battery Replacement Video](#).



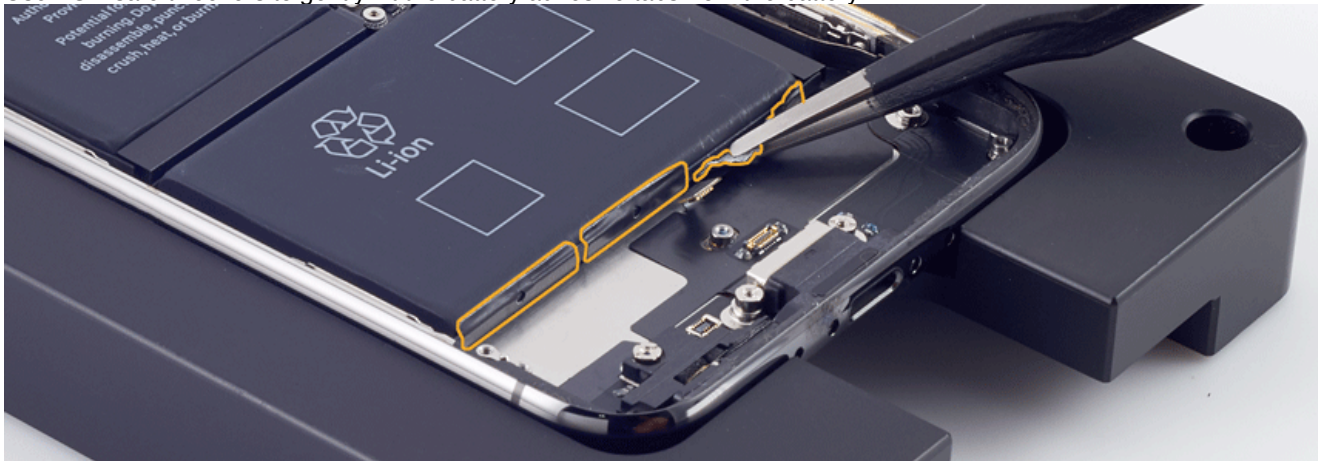
## Tools

1. ESD-safe tweezers
2. Black stick (922-5065)
3. Isopropyl alcohol (IPA) wipes
4. 5.8-inch repair tray (923-01920)
5. iPhone Battery Fixture (923-01917)
6. Nitrile or lint-free gloves



## Steps For Removal

1. Use ESD-safe tweezers to gently lift the battery adhesive tabs from the battery.



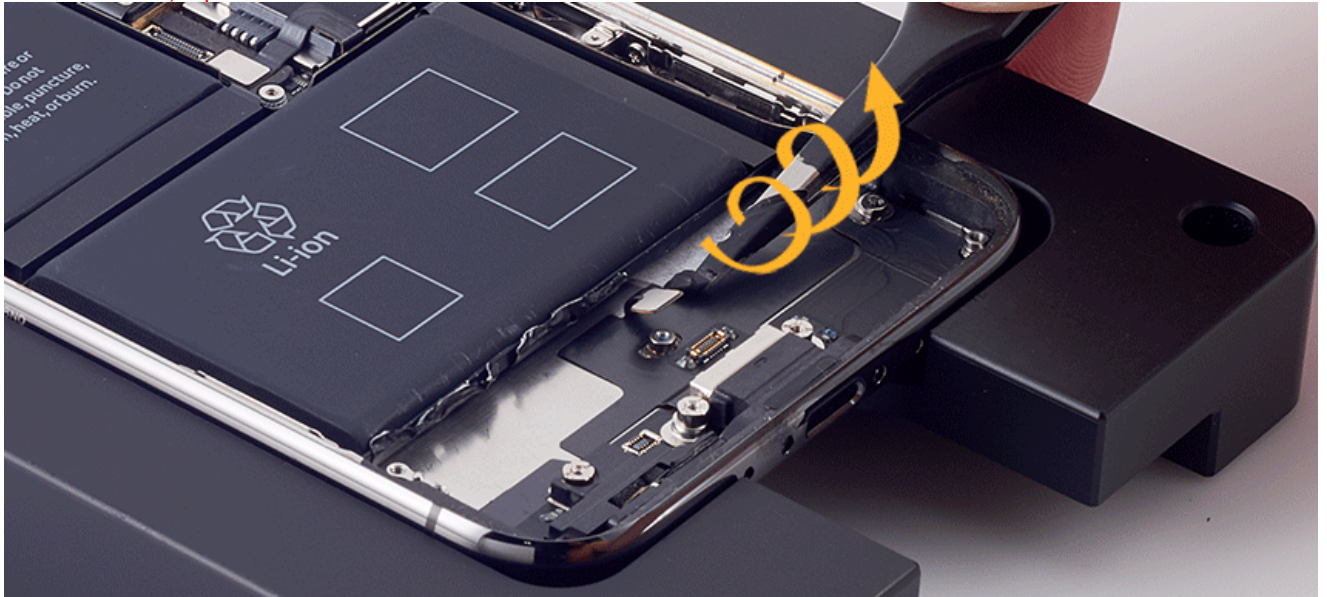
2. Grasp one adhesive strip and slowly pull it toward the bottom of the iPhone. Twist the battery tab on to the tweezers as the adhesive strip extends, grasp the strip closer to the battery and continue to pull slowly. Hold the battery with your fingers. **Important:** Avoid pulling the adhesive strips against components or screws.



**Note:** If an adhesive strip breaks, then attempt to retrieve the strip with ESD-safe tweezers. If the strip cannot be retrieved, then attempt to remove other strips.



**Warning:** If an adhesive tab or strip breaks off and cannot be retrieved, then **do not use tools to pry up the battery**. In this situation, replace the whole unit.

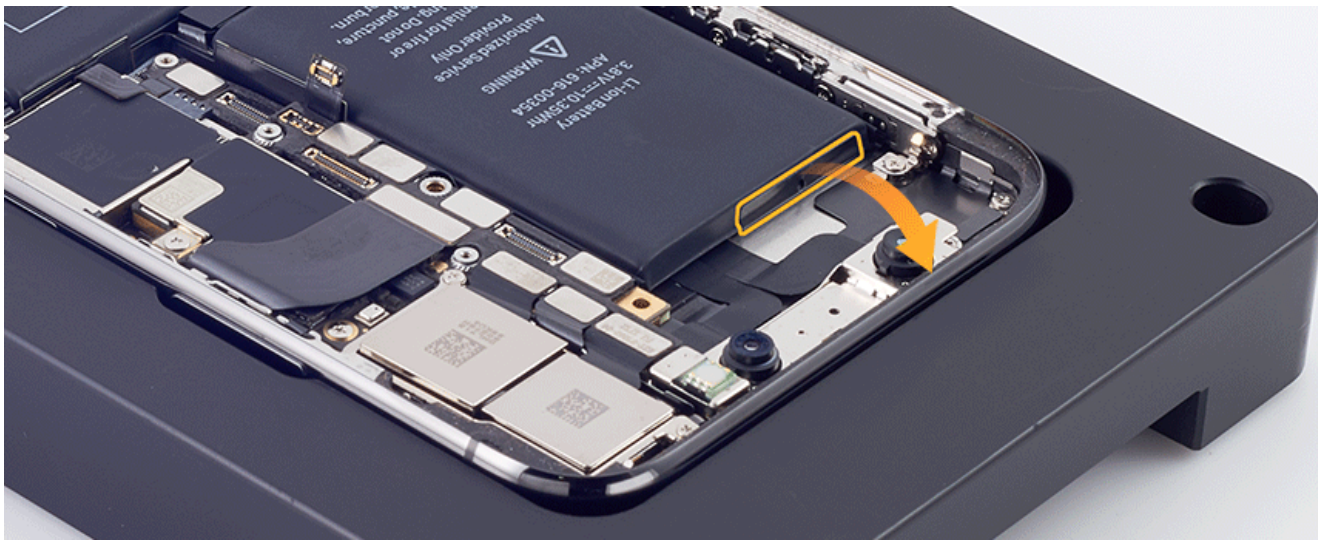


3. Continue to pull slowly until the adhesive strip releases.
4. Repeat steps 2 and 3 with the other adhesive strips. Avoid pulling the middle adhesive strip against the speaker flex.



5. Wearing Nitrile or lint-free gloves use ESD-safe tweezers to gently lift the top battery adhesive tab from the battery. **Important:** Avoid touching the TrueDepth Cameras and components near the cameras.



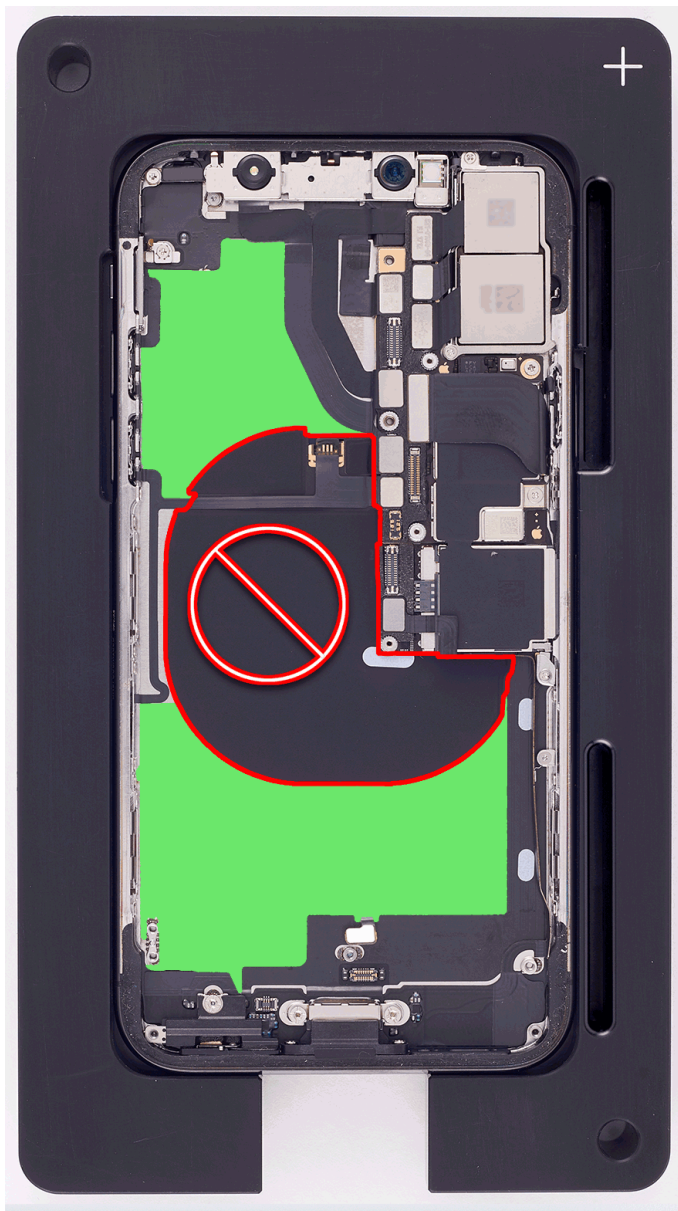


6. Grasp the top adhesive strip and slowly pull it toward the top of the iPhone. Twist the battery tab on to the tweezers as the adhesive strip extends, grasp the strip closer to the battery and continue to pull slowly. Hold the battery with your fingers. **Important:** Avoid touching the TrueDepth Cameras and components near the cameras.

**Note:** If the adhesive strip breaks, then attempt to retrieve the strip with ESD-safe tweezers.



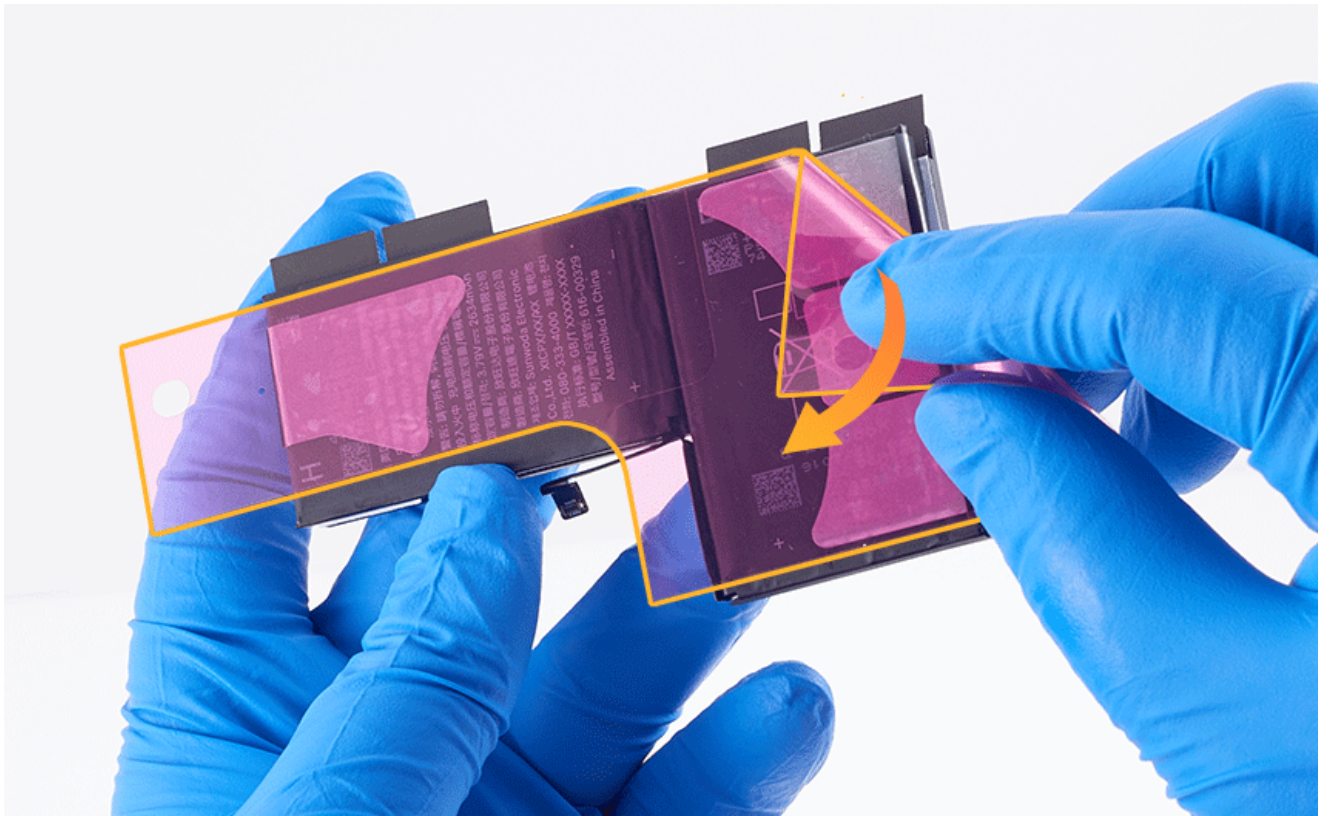
7. Remove the battery from the enclosure. Support both parts of the battery to avoid damaging the battery.
8. Use IPA wipes in the area marked in green to remove any remaining adhesive from the enclosure underneath the battery. **Important:** Avoid the area outlined in the red, IPA may cause damage to the mylar.



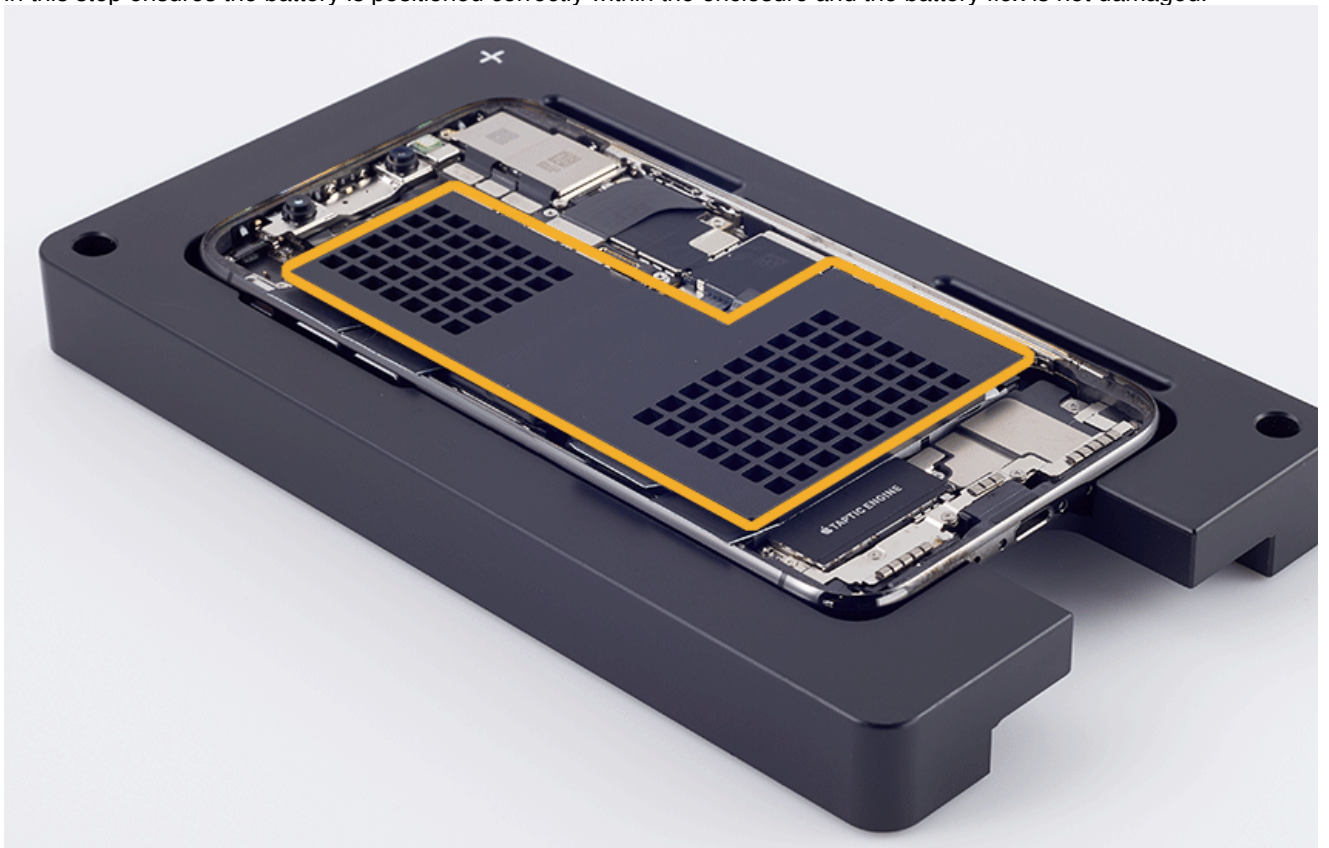
## Steps For Reassembly

1. Reinstall the [Taptic Engine](#).
2. Install a new [Speaker](#).
3. Peel the pink release liner from the battery to expose the adhesive that will attach to the enclosure. Do not remove the protective cover.

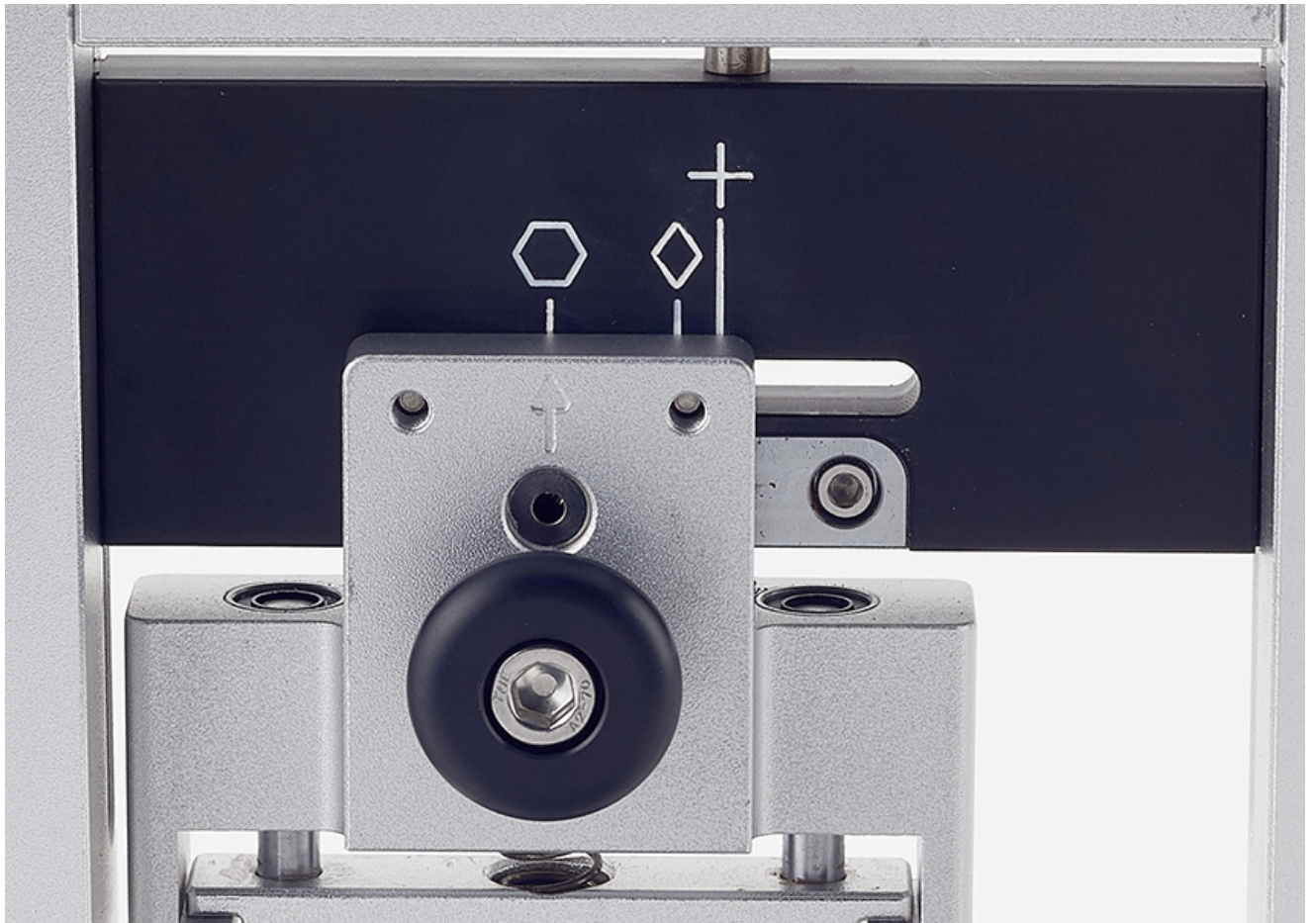




4. Position the battery in the enclosure and connect the battery connector to the logic board. **Note:** Connecting the battery in this step ensures the battery is positioned correctly within the enclosure and the battery flex is not damaged.

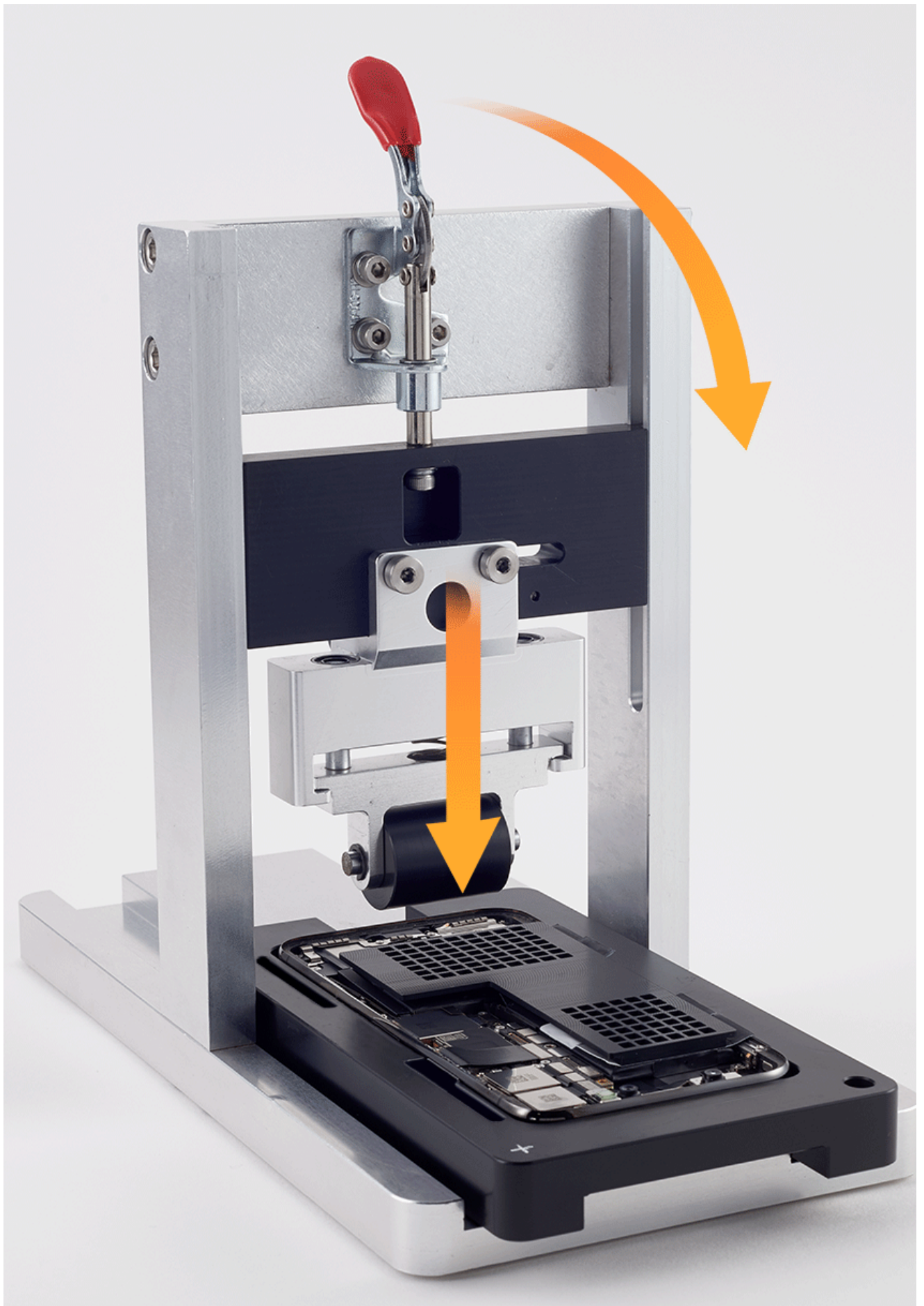


5. Make sure that the iPhone Battery Fixture roller is set to the hexagon position.



6. Put the repair tray into the iPhone Battery Fixture with the battery positioned underneath the roller. Make sure the tray is at the end of the range of motion.
7. Lower the red lever to move the pressure roller into place above the iPhone battery.



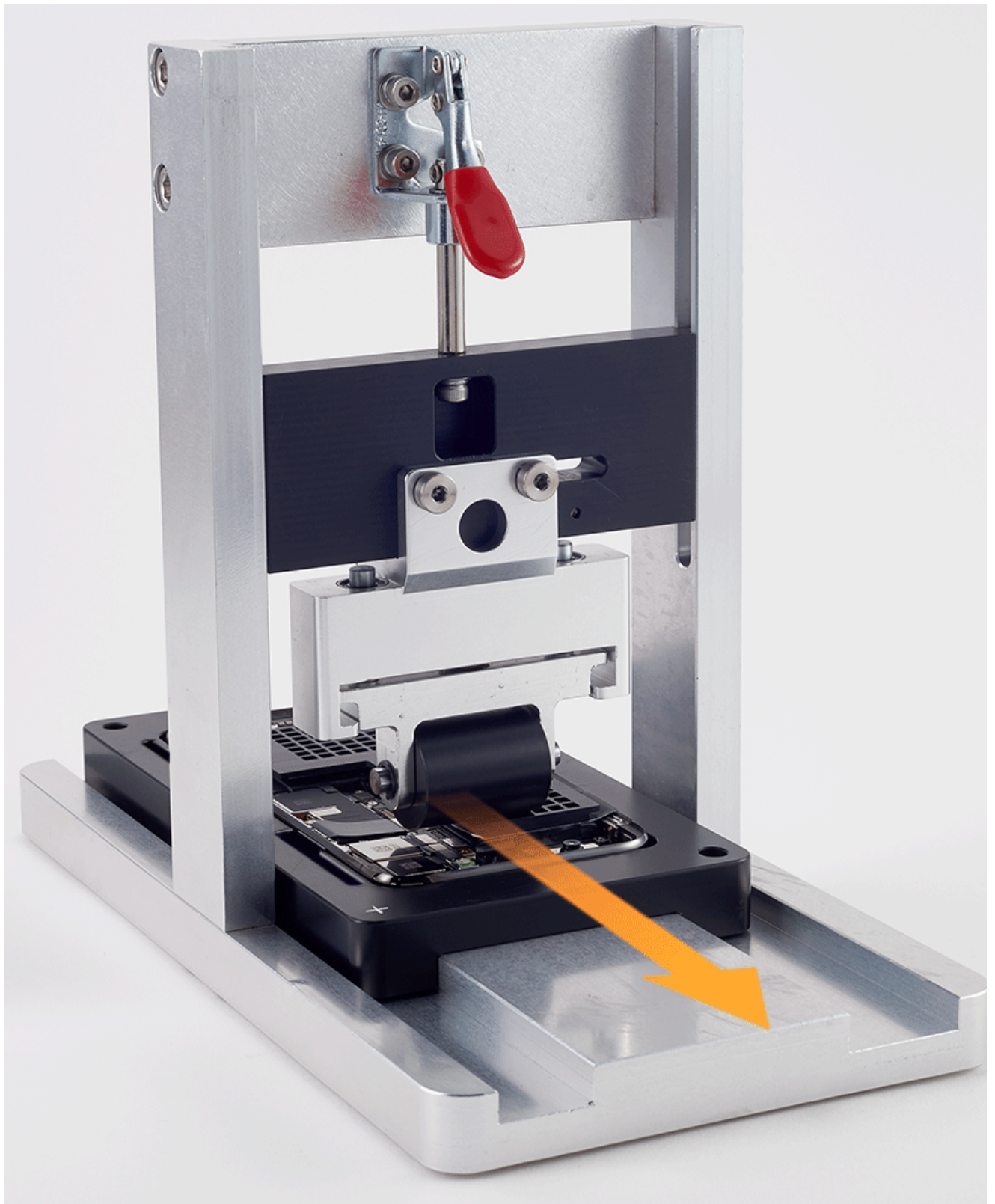


8. Slide the tray through the tower until it is at the end of the range of motion. This will cause the roller to press the battery down onto the adhesive strip.



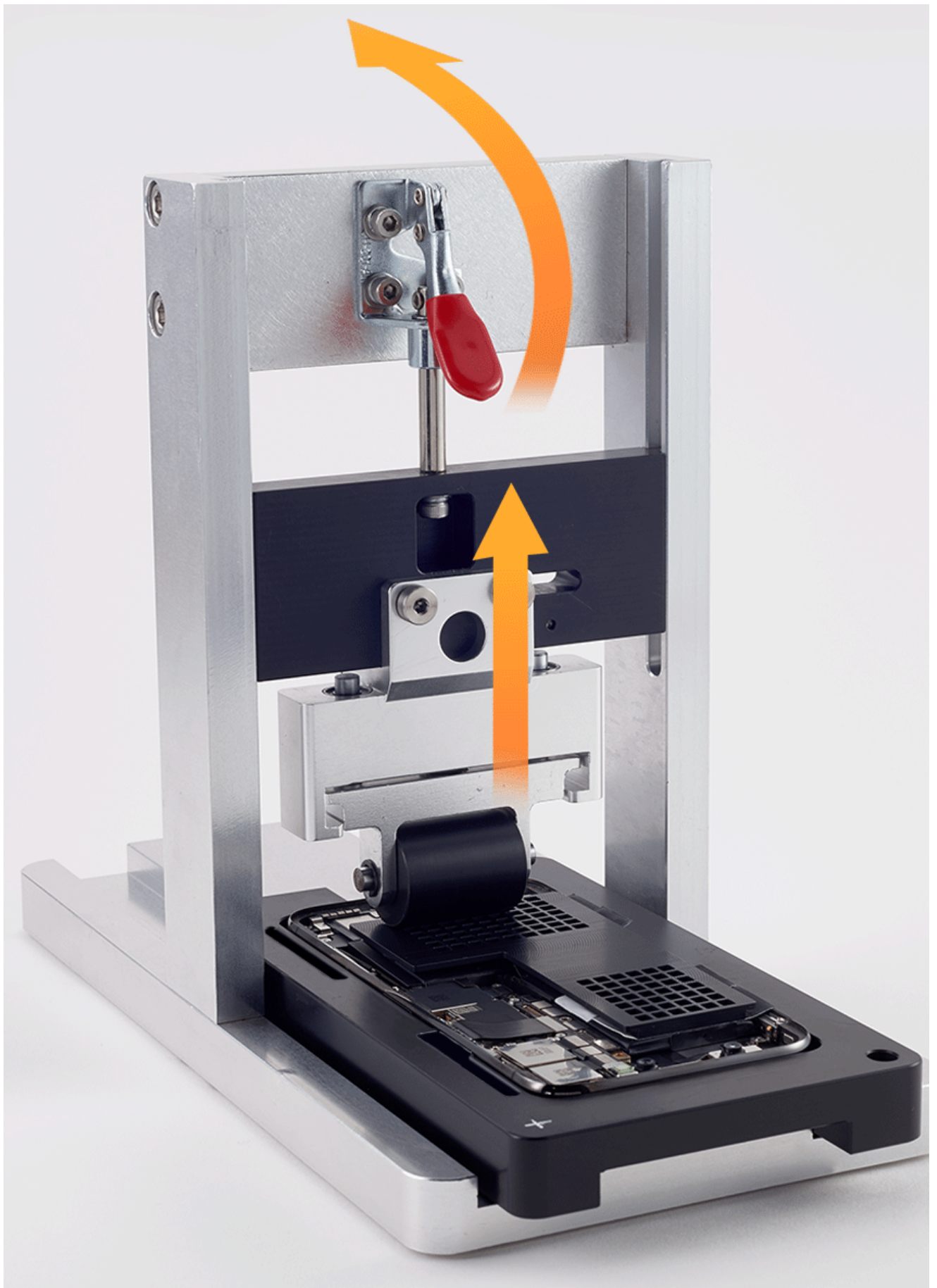


9. Slide the tray back through the vertical tower to the original position.



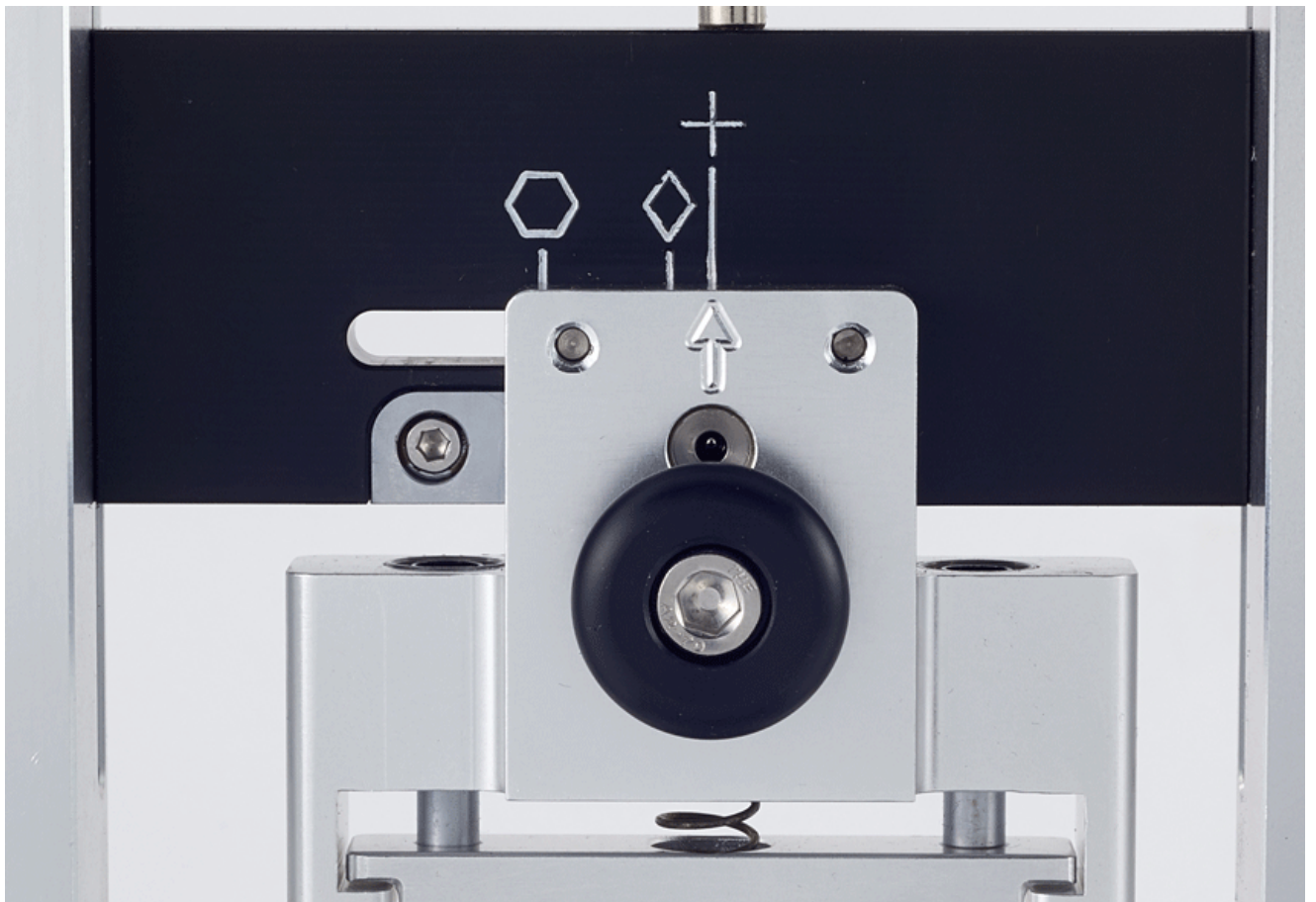
10. Raise the red lever to raise the pressure roller.



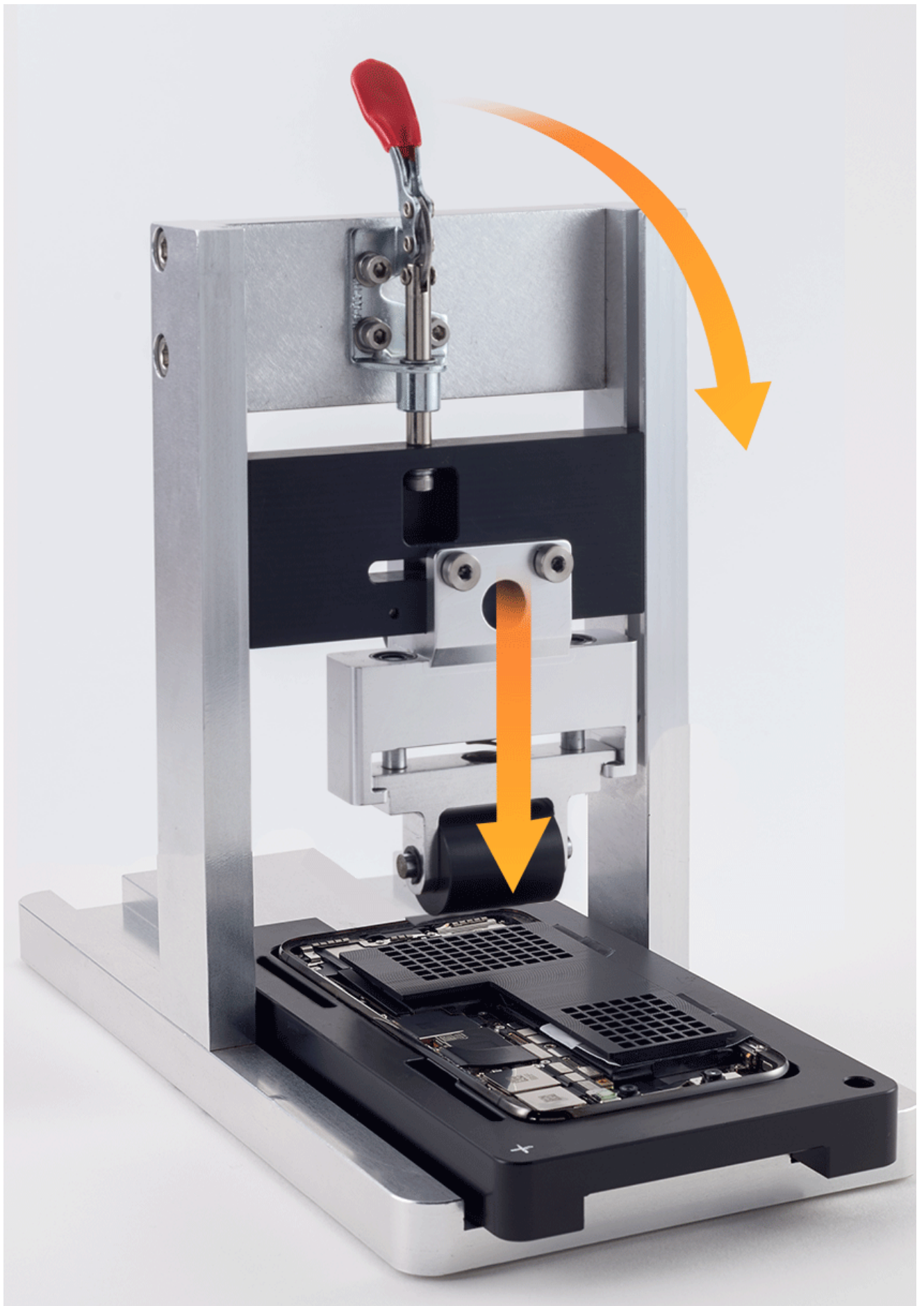


11. Slide the roller to the Plus position.





12. Lower the red lever to move the pressure roller into place above the iPhone battery.

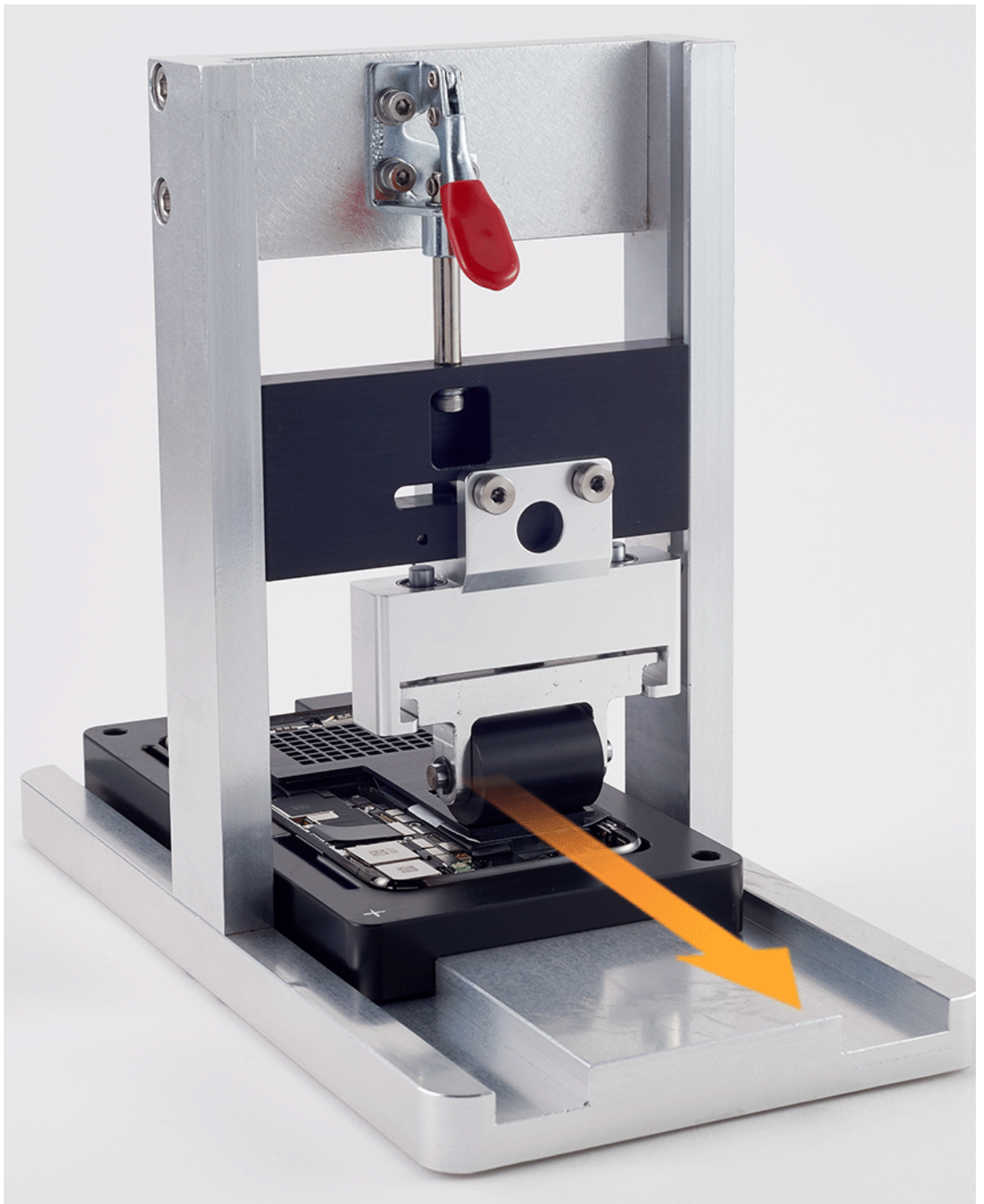


13. Slide the tray through the tower until the end of the range of motion. This will cause the roller to press the battery down onto the adhesive strip.



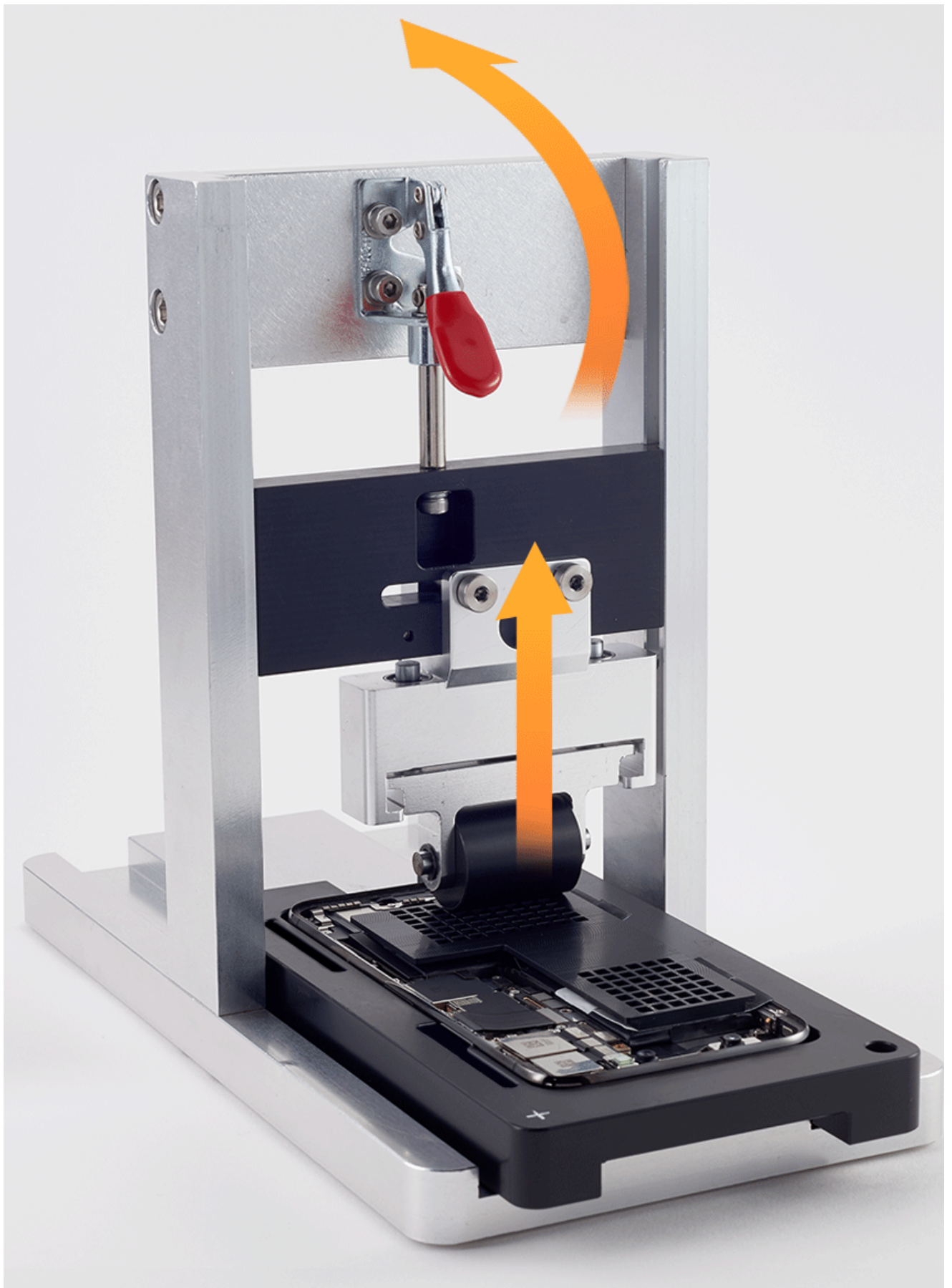


14. Slide the tray back through the tower to the original position.



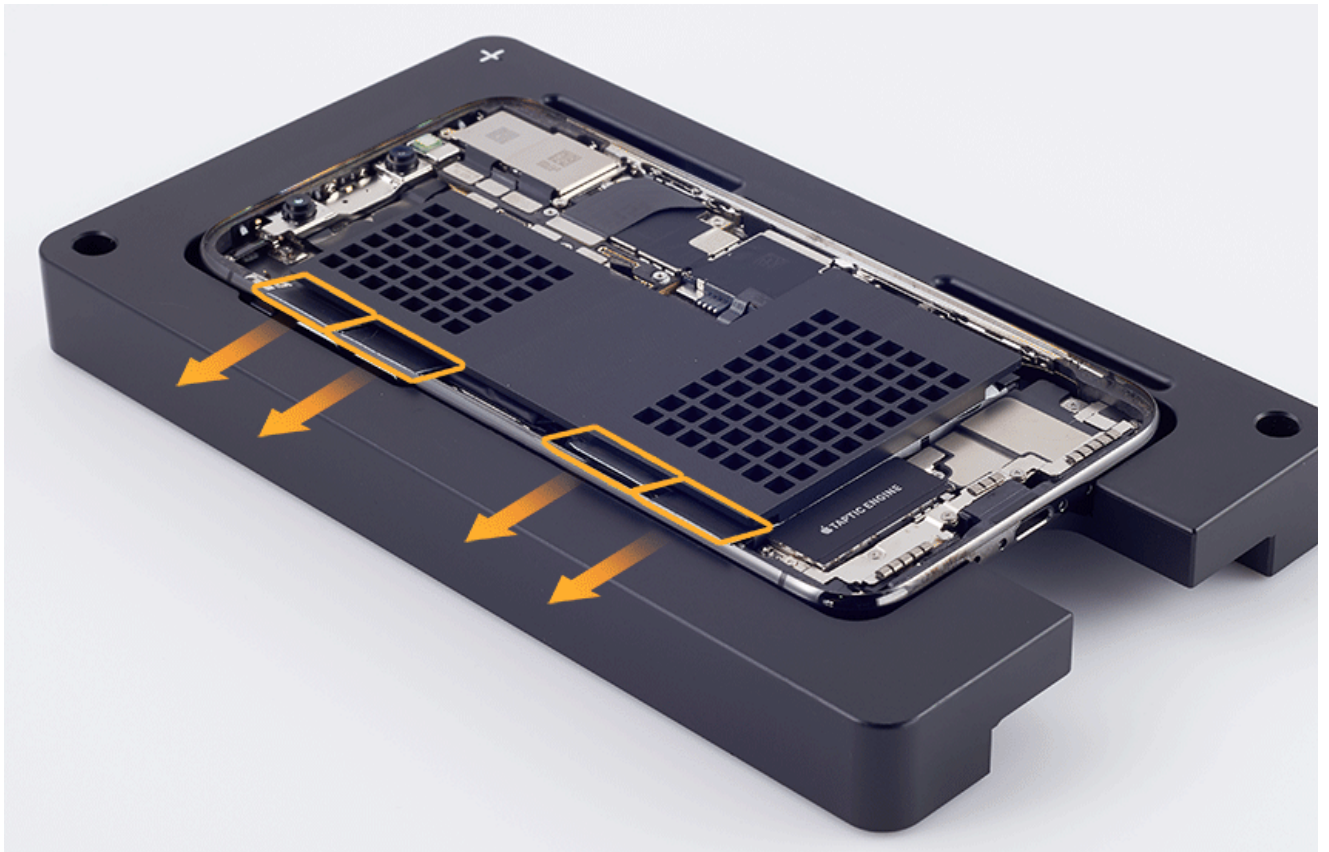
15. Raise the red lever to raise the pressure roller.



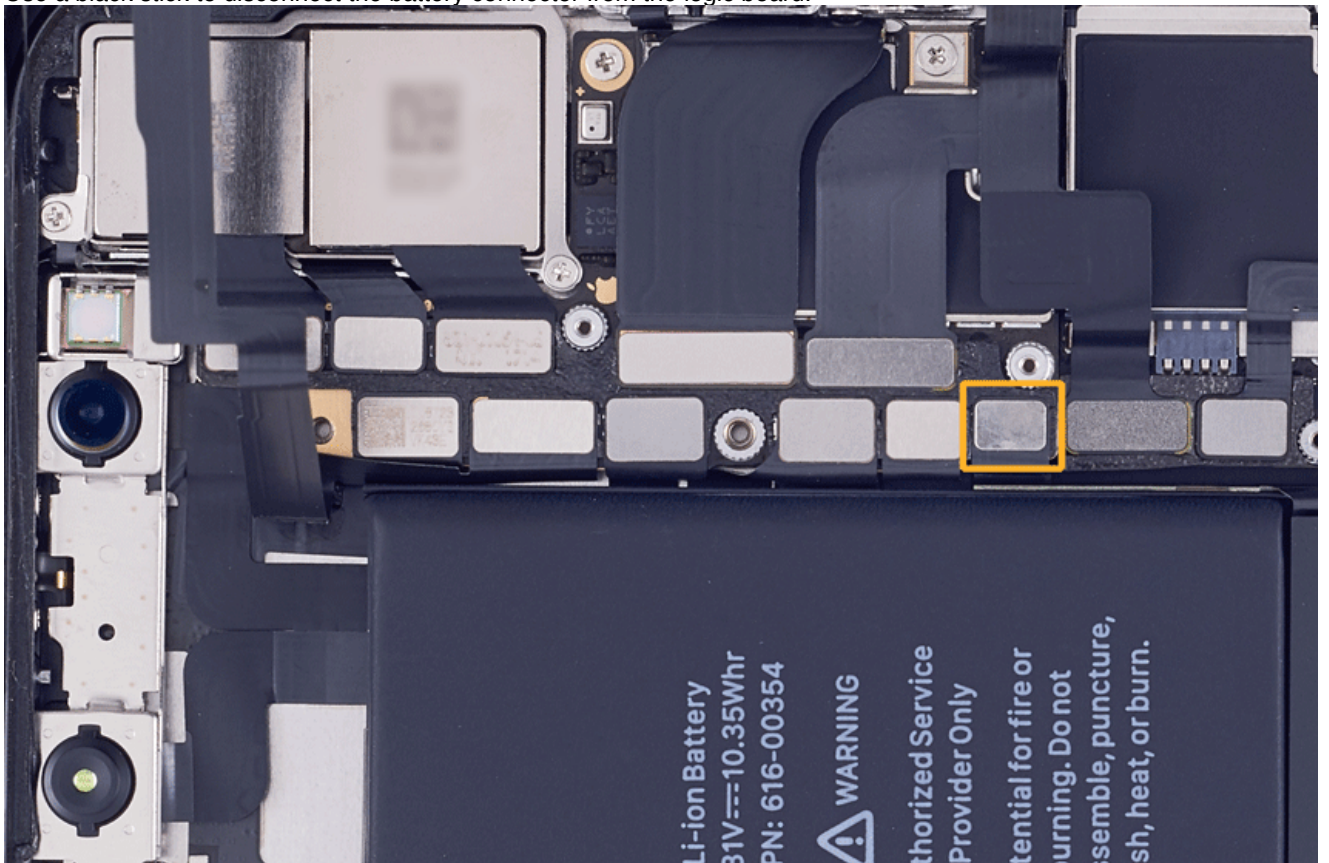


16. Repeat steps 5–15 once again, then proceed to step 17.
17. Pull the release tabs on the protective cover and remove it from the battery.





18. Use a black stick to disconnect the battery connector from the logic board.



19. Follow the reassembly steps in article [RP1397: Open Device](#).
20. Gently shake the iPhone and listen for a battery rattling sound. If the battery is moving, then [open device](#), repeat reassembly steps 5–16, and [close device](#). If rattling still occurs, then replace the battery with a new battery.
21. Run the recommended AST 2 diagnostic suites found in article [TP1570: Diagnostics Mode](#).
22. **Important:** Check iPhone operation using the AST 2 diagnostics suites recommended in article [TP1570: Diagnostics Mode](#). If AST 2 is not available, follow the steps in article [TP1045: Functional Test](#).





# Camera

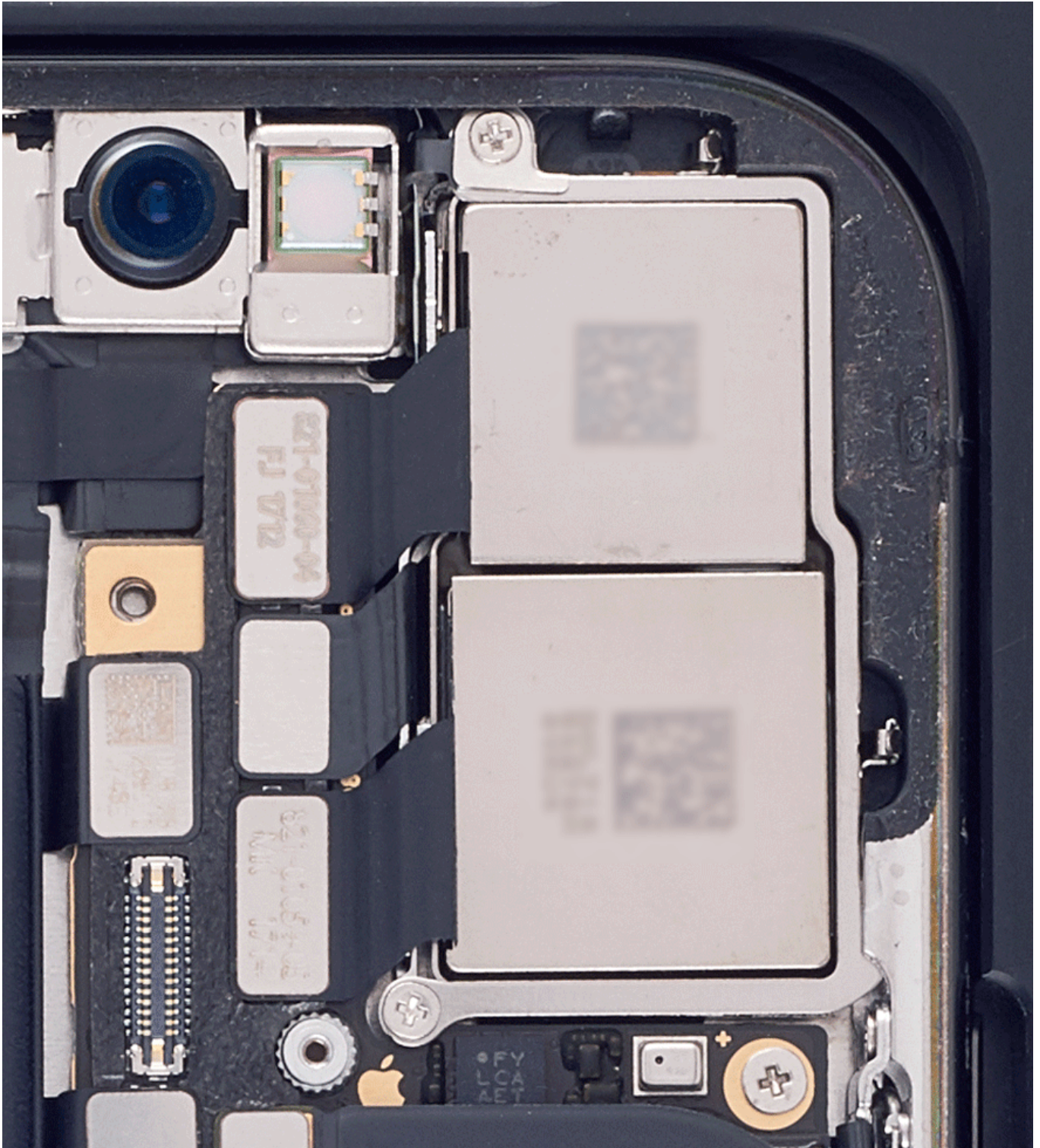
## First Steps

- Perform the [Open Device](#) procedure.

### Important:

- This procedure should only be performed by Apple-certified technicians.
- Wear nitrile or lint-free gloves to prevent contamination of the camera lens.
- Avoid touching the TrueDepth Cameras and components near the cameras.
- When entering the serial number for the repair transaction, use the serial number of the wider camera closest to the bottom of the enclosure.

For video instruction, refer to article [SV361: iPhone X Camera Replacement Video](#).



## Tools

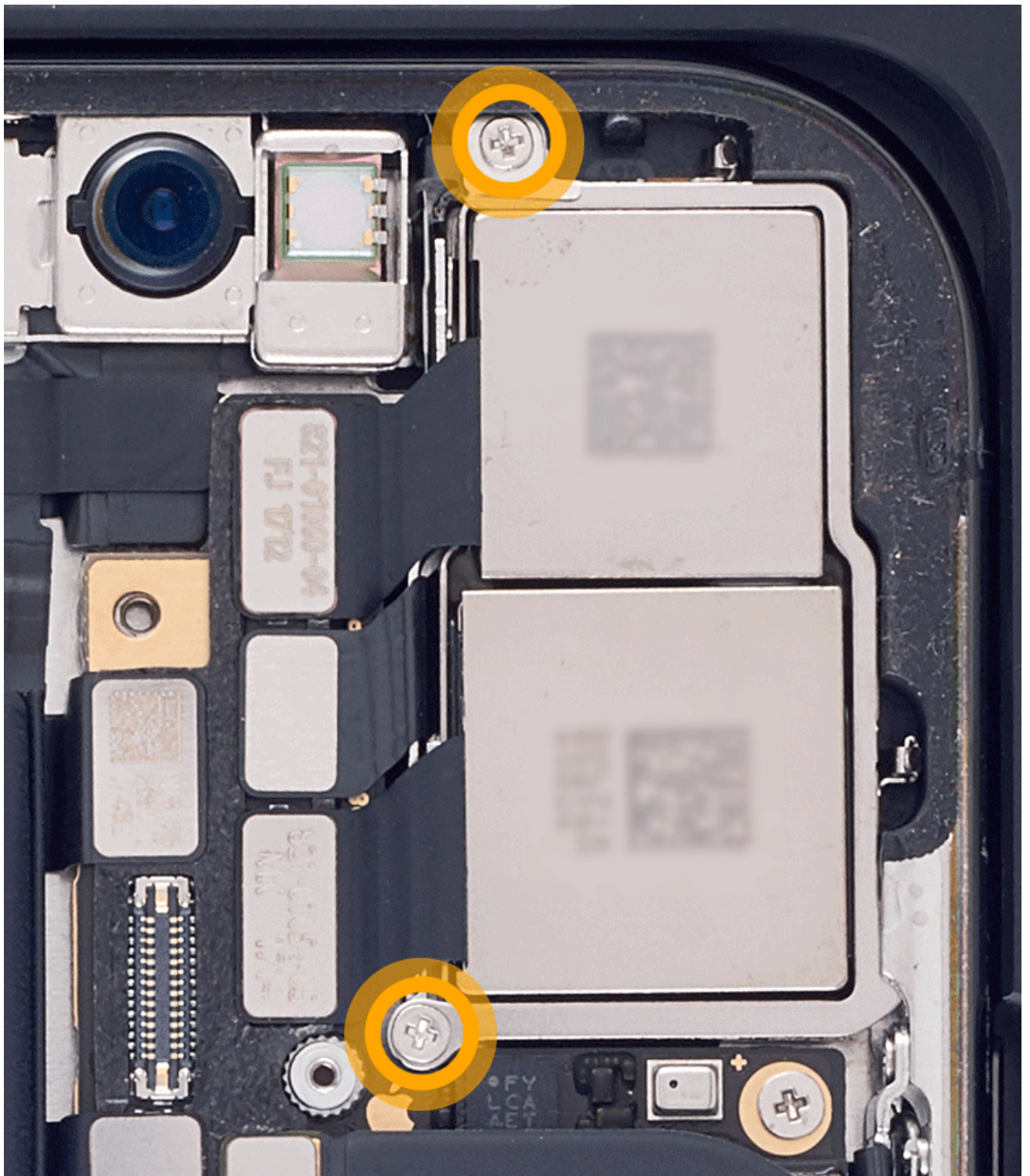


1. iPhone torque driver (black) (923-0248)
2. JCIS bit (923-0246) for cross-head screws
3. ESD-safe tweezers
4. Black stick (922-5065)
5. Nitrile or lint-free gloves



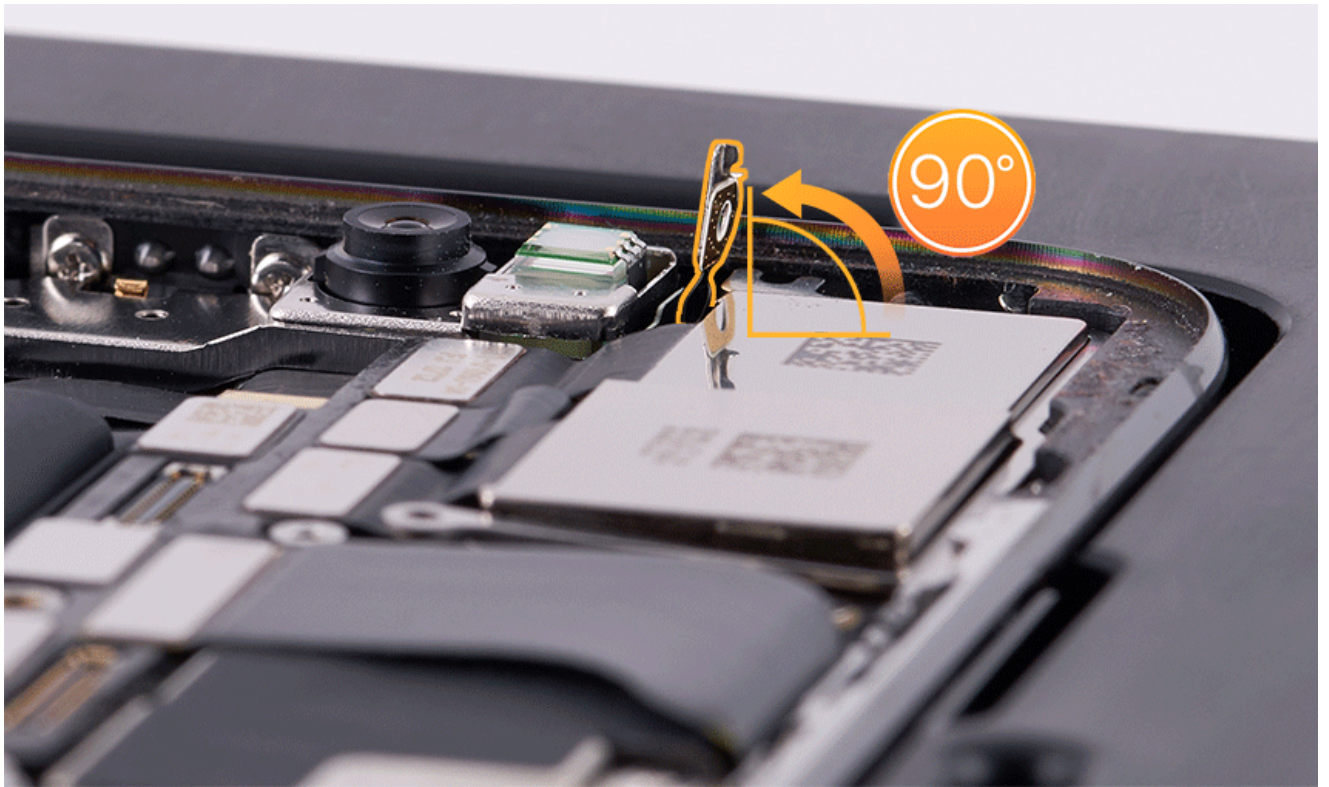
### Steps For Removal

1. Use the iPhone torque driver and JCIS bit to remove and discard two cross-head screws from the camera cowling.  
**Important:** Avoid touching the TrueDepth Cameras and components near the cameras.

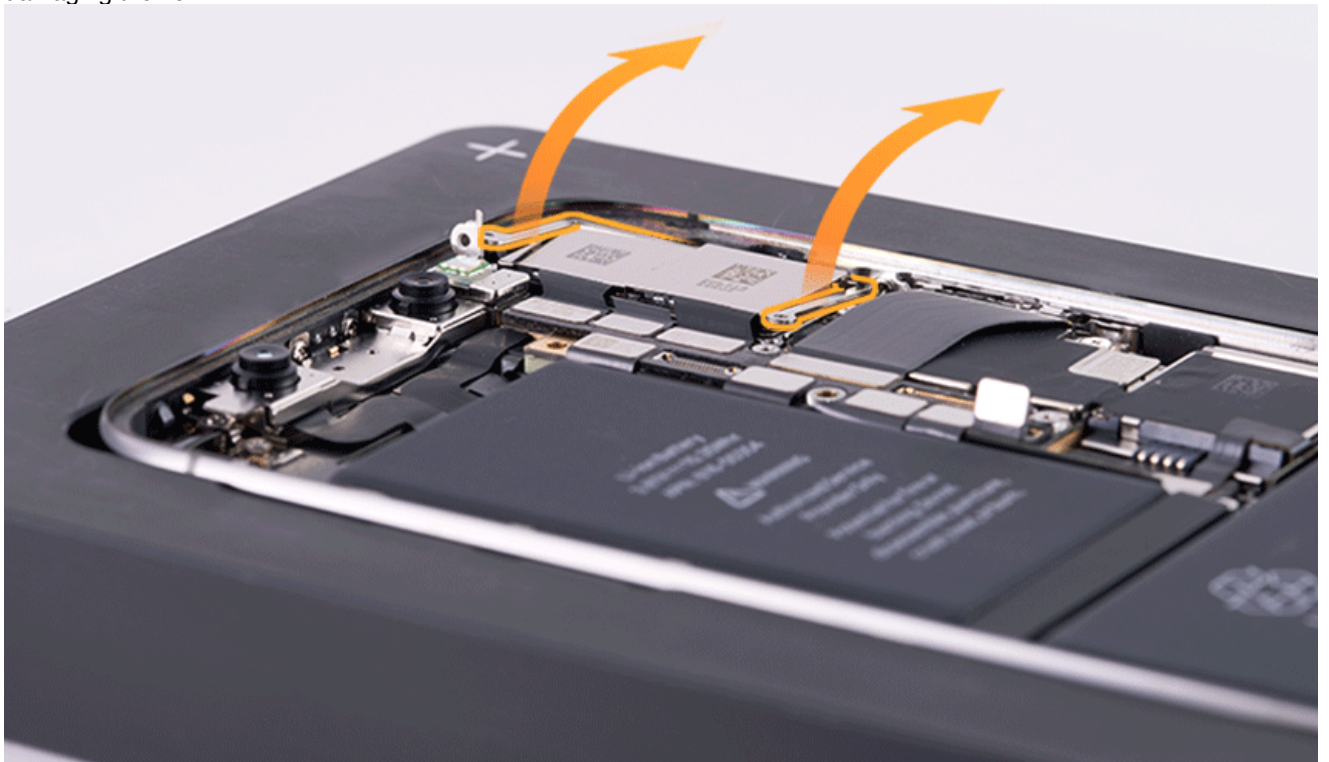


2. Gently lift the grounding flex. **Important:** Do not bend flex beyond 90° to avoid damaging the flex.



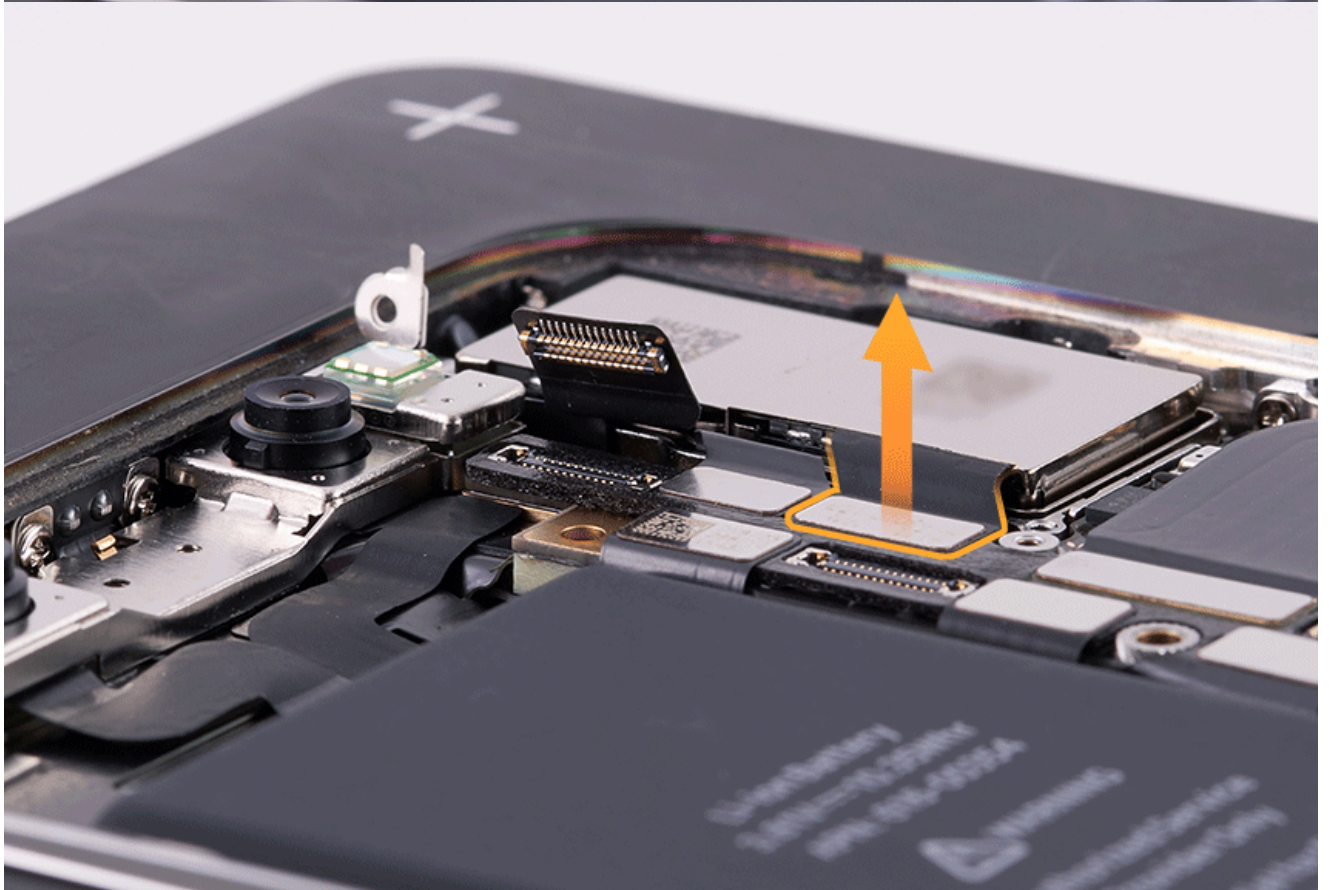
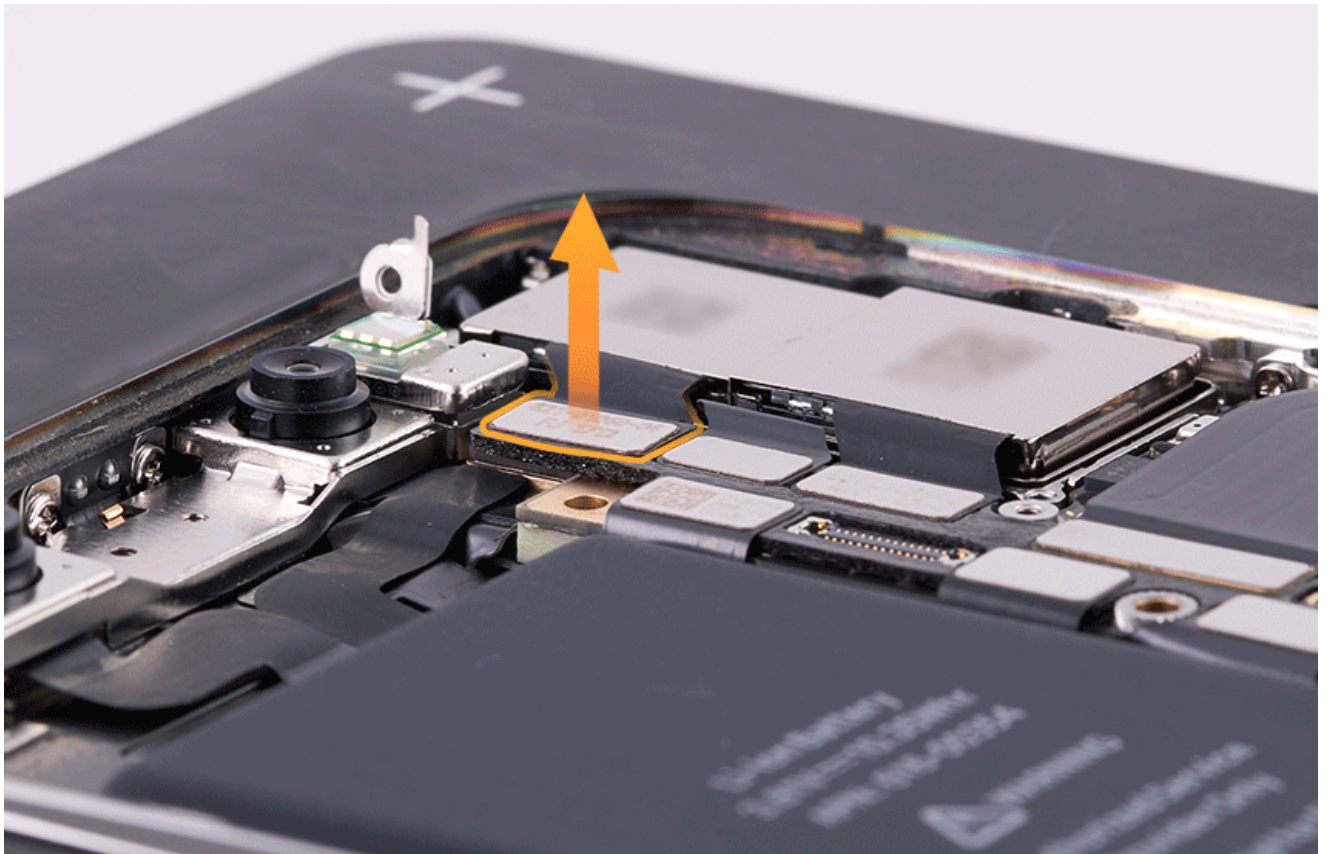


3. Lift the camera cowling. Save for reuse. **Important:** Be sure the grounding flex is not obstructing the cowling to avoid damaging the flex.



4. Disconnect the two camera flexes, then remove the camera from the enclosure.

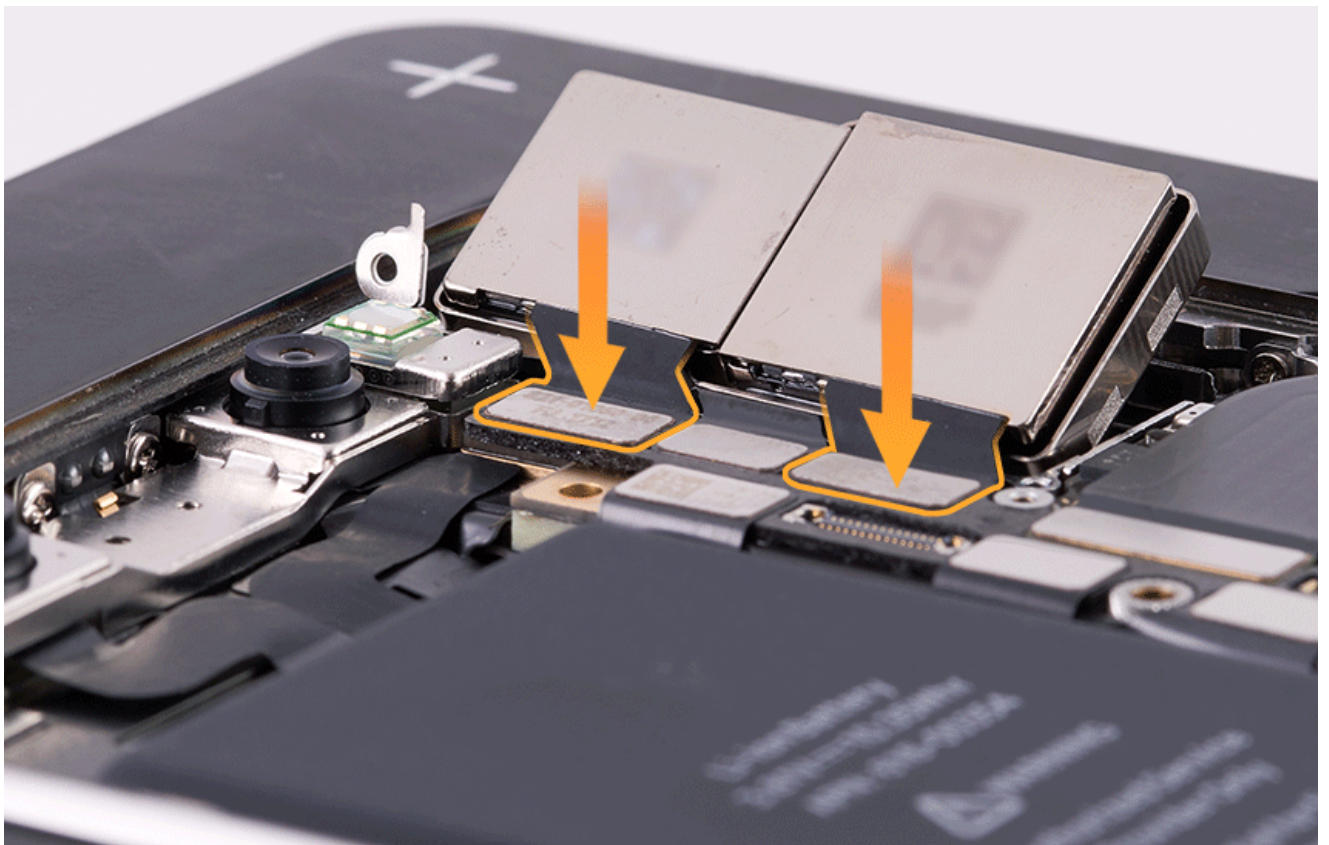




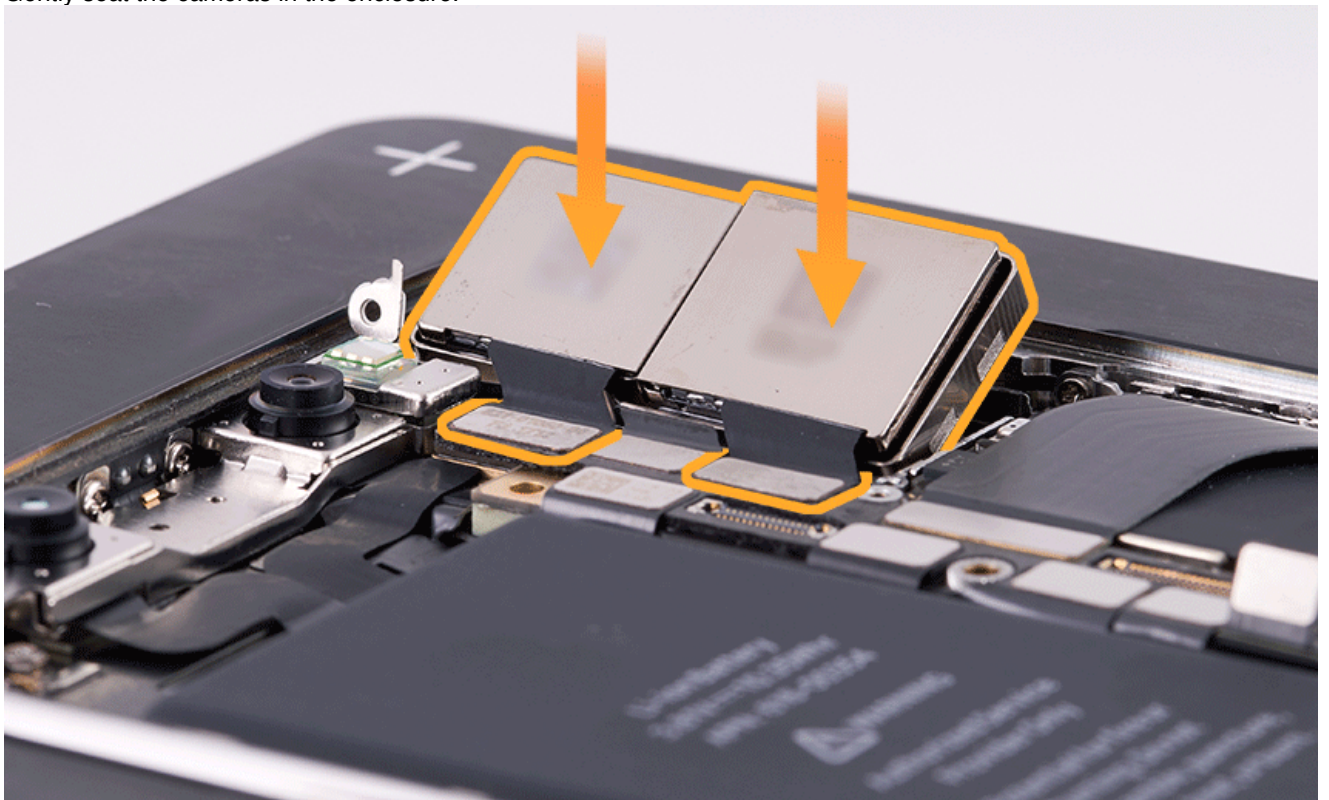
### Steps For Reassembly

1. Wearing nitrile gloves, remove the protective lens cover from the replacement camera.
2. Position the camera in the enclosure.
3. Connect the two camera flex connectors to the logic board.



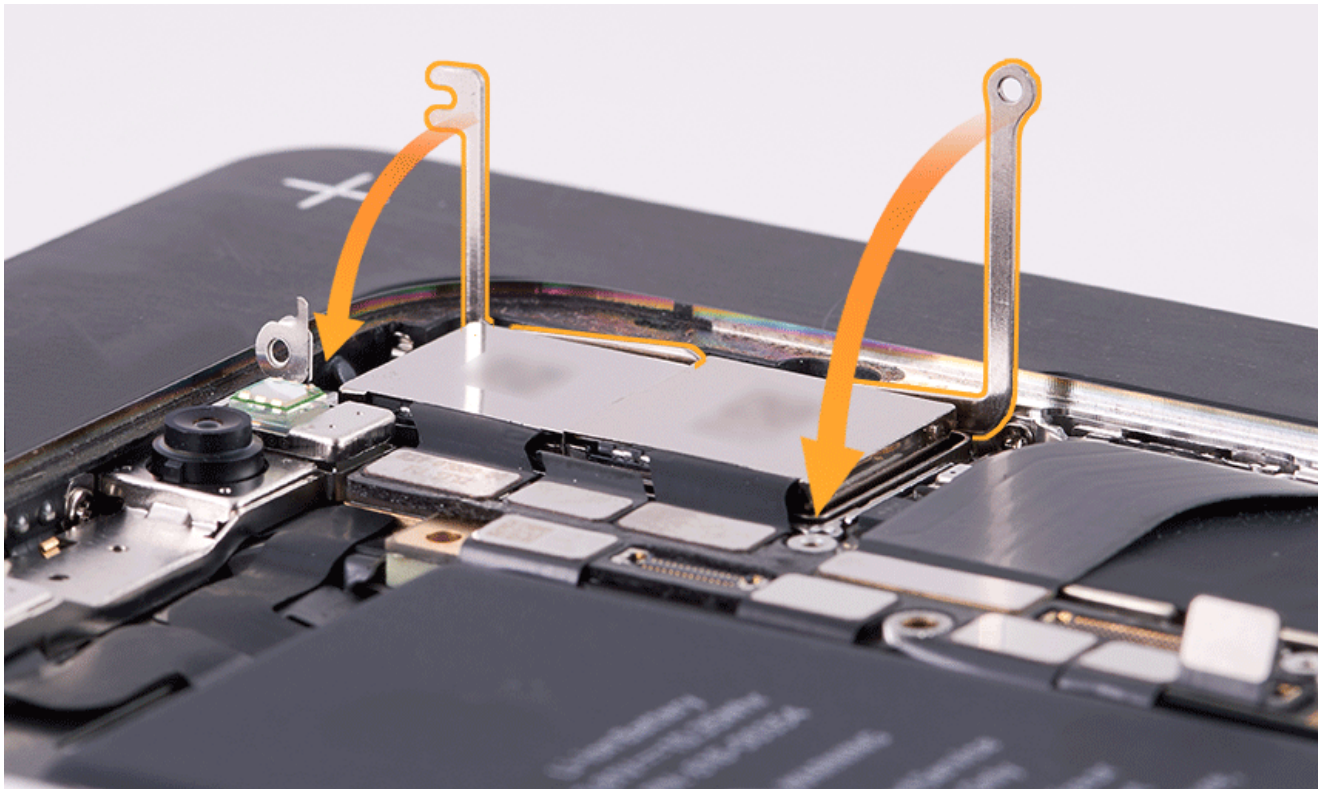


4. Gently seat the cameras in the enclosure.

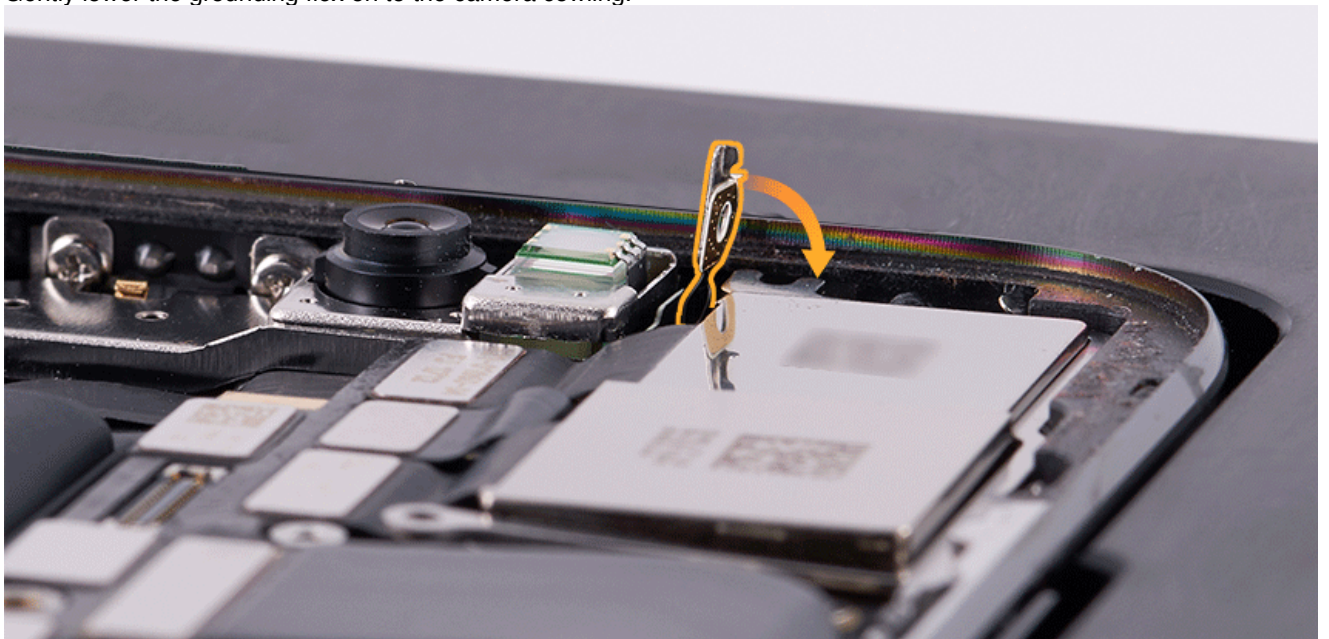


5. Place the camera cowling (923-01969) on the camera. **Important:** Do not trap the grounding flex under the camera cowling.

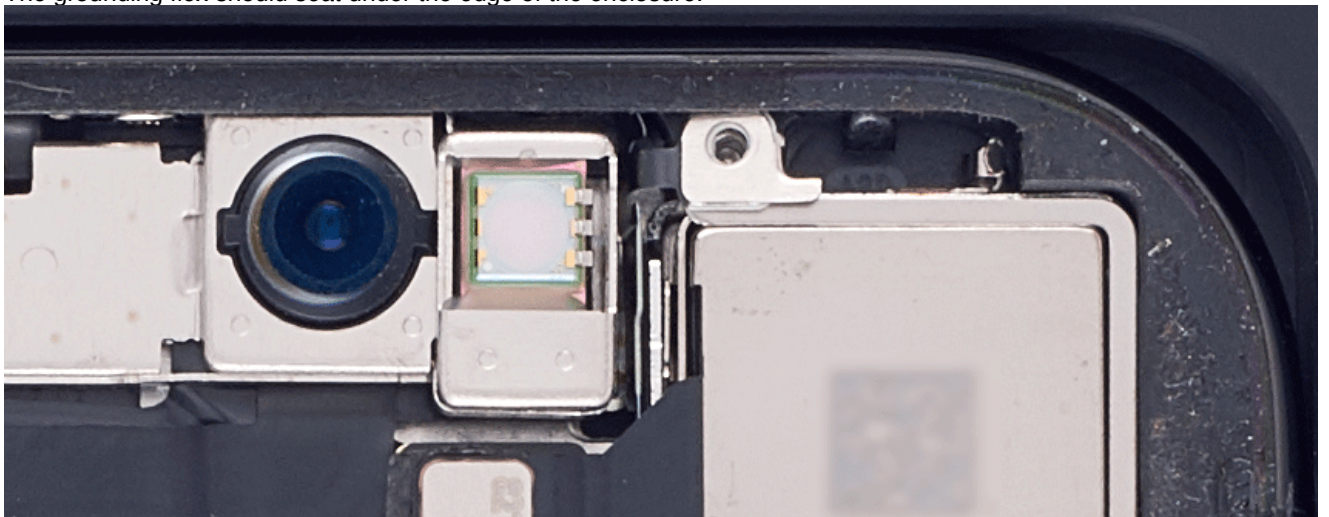




6. Gently lower the grounding flex on to the camera cowling.



The grounding flex should seat under the edge of the enclosure.

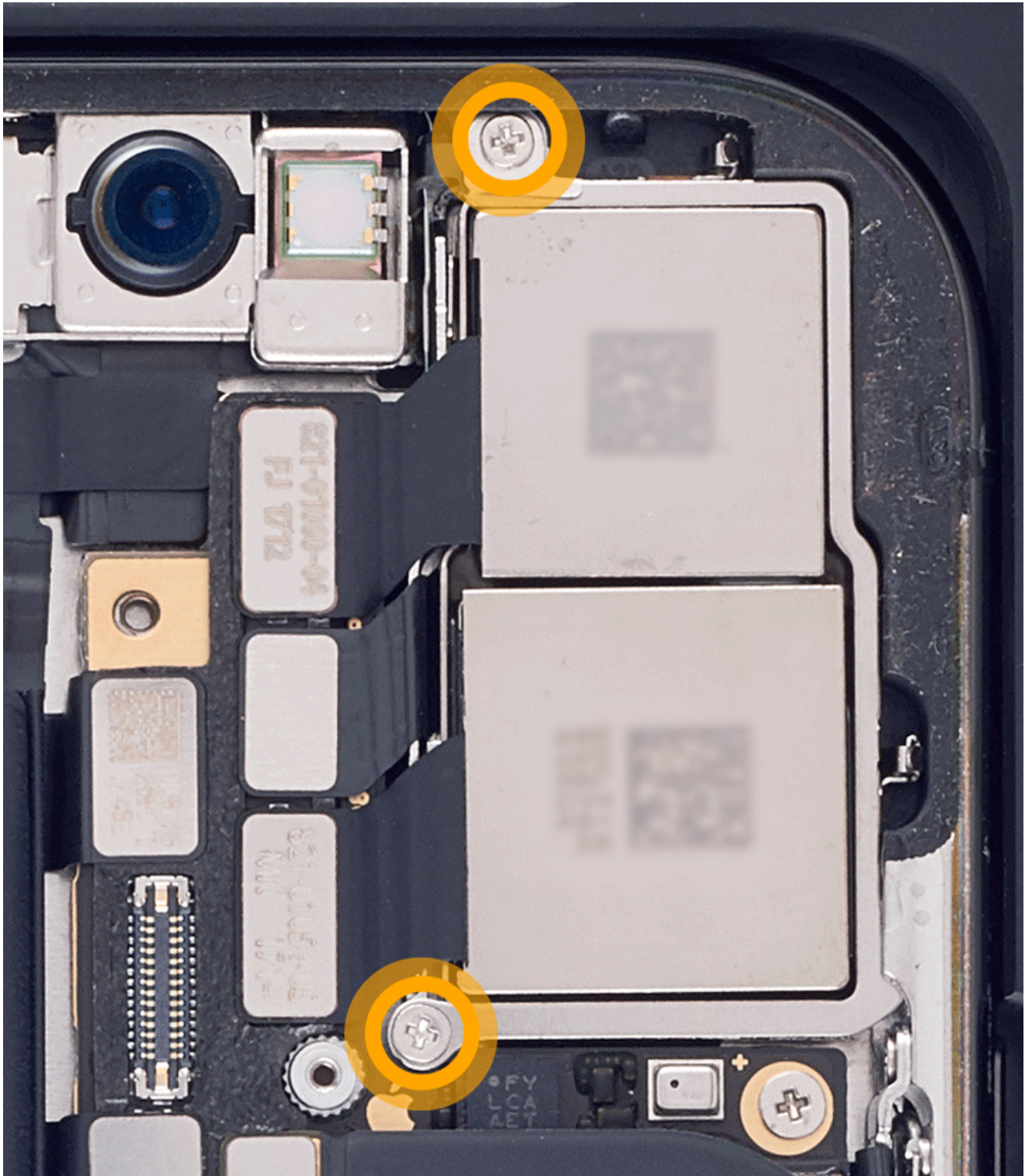


7. Use the iPhone torque driver (black) and JCIS bit to install two new cross-head screws in to the camera cowling.



**Important:** Be sure the grounding flex does not rotate when installing the screw. Do not over-torque the top screw to avoid damage to the grounding flex.

- 923-02030, top
- 923-01967, bottom



8. Follow the reassembly steps in article [RP1397: Open Device](#).
9. Run the AST 2 Camera Image Quality suite to calibrate the rear camera and evaluate camera image quality after repair.
10. **Important:** Check iPhone operation using the AST 2 diagnostics suites recommended in article [TP1570: Diagnostics Mode](#). If AST 2 is not available, follow the steps in article [TP1045: Functional Test](#).

# Completing a Repair

## Test Functionality

Test the device according to the procedures outlined in [TP1045: Functional Test](#). Attempt to repeat the original issue(s) reported by the user, using whatever function(s) of the device were affected.

The device should be 100 percent operational before giving it back to the user.

## Verify Cellular Account

Make sure the user's SIM card is installed and ask the user to verify their phone number is correct in Settings > Phone.

## Clean Device

Clean the device with a micro-fiber polishing cloth. **DO NOT** use chemicals or liquids.

## Handle Defective Parts

All defective modules should be returned to Apple. Reuse the packaging that contained the replacement part(s).



# iPhone Functional Test

The purpose of this procedure is to determine the functional state of an iOS device before and after a repair. Before a repair, use this procedure to determine if any additional service is needed. After a repair, for devices running 10.3 or later, use Diagnostics Mode to run the AST 2 diagnostic suite(s) recommended in [TP1570: Diagnostics Mode](#) to verify the device's functionality. Devices running iOS 10.2.1 and earlier should continue to use the functional tests listed in this article. **Note:** Some feature-specific tests may not apply to the device under test.

Attempt to repeat the original issue or issues reported by the user and verify that no new issues are present after opening the device. If the user is reporting battery issues, use AST 2 to test the battery. Confirm that the device is fully operational before returning it to the user. Use AST 2 diagnostics to assist in testing for reported issues. See [TP1279: Supported Products and Tests](#) for more information on AST 2 diagnostics.

1. Test Cellular and Wi-Fi Connectivity, Video Playback, and Speaker Sound Quality
2. Test Bluetooth
3. Test Headset and Proximity Sensor
4. Test Bottom Mic, Speaker, and Receiver Sound Quality
5. Test Cameras, Rear Mic, and Front Mic
6. Test Multi-Touch and Accelerometer
7. Test Buttons, Switches, and Vibe
8. Test Ambient Light Sensor
9. Test Location Services
10. Test Touch ID (iPhone 5s, SE, 6, 6 Plus, 6s, 6s Plus, 7, 7 Plus, 8, 8 Plus)
11. Test 3D Touch and Taptic Engine (iPhone 6s and later)
12. Test True Tone Display (iPhone 8, 8 Plus, and X)
13. Test Face ID (iPhone X only)

## 1. Test Cellular and Wi-Fi Connectivity, Video Playback, and Speaker Sound Quality

- a. Run the Mobile Resource Inspector (MRI) diagnostic suite in AST 2, which tests for the presence of Wi-Fi hardware.
- b. Check that the user's SIM card is installed. Ask the user to verify that their phone number is correct in Settings > Phone.
- c. Make a test phone call to an approved toll-free number. This will test cellular connectivity and sound quality for phone calls.
- d. Go to Settings > Wi-Fi and connect to a known-good Wi-Fi network.



- e. Play video from apple.com and verify that the video and audio play correctly. This will test the video playback and the speaker. For iPhone 7, 7 Plus, 8, 8 Plus, X: Hold device in landscape orientation. Go to Settings > General > Accessibility and adjust balance to the left, and then to the right. Be sure that Mono audio is turned off. Replay the video to test the left and right speakers in isolation.
- f. Repeat steps d and e connected to a 2.4GHz network and connected to a 5GHz network, if available.

## 2. Test Bluetooth

- a. Run the MRI diagnostic suite in AST 2, which tests for the presence of Bluetooth hardware.
- b. Make a known-good Bluetooth device available locally. Check that the Bluetooth device is on and discoverable.
- c. On the customer's device, go to Settings > Bluetooth.
- d. Verify that Bluetooth is on. The device will search for nearby Bluetooth devices.



- e. Pair the user's device with the Bluetooth device.
- f. To unpair a device, tap the blue circle to the right of the device's name and then tap "Forget this Device."

### 3. Test Headset and Proximity Sensor

- a. Connect EarPods to iPhone.
- b. Launch the Voice Memos app.



- c. Record a short voice memo by tapping the red circle. Blow in to the headset microphone to verify functionality.
- d. While recording, cover the top front of the iPhone with your hand. The display should go blank.
- e. Remove your hand. The display should turn back on when the proximity sensor is uncovered.
- f. When finished recording, tap Done.
- g. Enter a name for the recording, then tap OK.
- h. Tap the recording.
- i. Tap the play (triangle) button to begin playback. Listen to the playback through the EarPods, and adjust volume using the headset remote control.
- j. Make a test phone call with a known-good SIM and with full cellular signal strength for at least one minute. During the call, verify the sound quality of the EarPods and headset microphone.

### 4. Test Bottom Mic, Speaker, and Receiver Sound Quality

a. Launch the Voice Memos app.



b. Record a short voice memo by tapping the red circle.

c. When finished recording, tap Done.

d. Enter a name for the recording, then tap OK.

e. Tap the recording.

f. Tap the play (triangle) button to begin playback. **Note:** To toggle between receiver and speaker, use the Speaker button in the top right corner of the display.

g. Make a test phone call with a known-good SIM and with full cellular signal strength for at least one minute. During the call, verify the sound quality of the receiver, speaker, and microphone.

## 5. Test Cameras, Rear Mic, and Front Mic

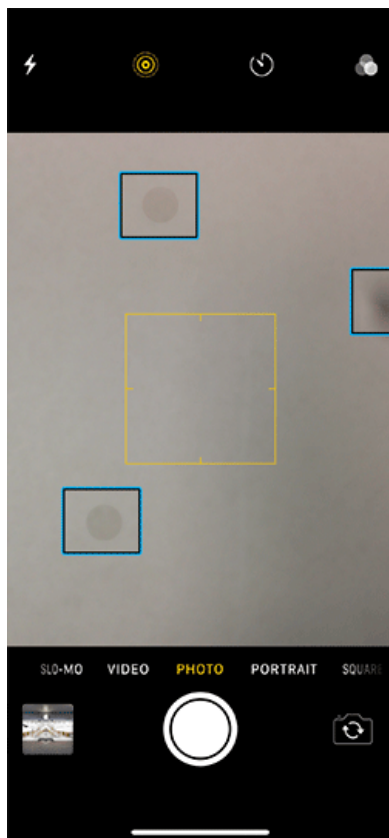
a. Run the MRI diagnostic suite in AST 2, which tests for the presence of front and rear cameras.

b. Remove any protective case that may interfere with the camera lens or flash.

c. Download the [iPhone Camera Test Image](#) (PDF) and print out a color copy on white, unlaminated paper. Do not modify, alter, or laminate the image.

d. Launch the Camera app. Aim the device at a clean, blank sheet of white paper.

e. Move the device slowly and inspect the preview image for anomalies, such as circles or dust spots.



f. Record video with the camera. Check the recording for video and audio quality. This will test the camera and rear mic.

g. Take photos and check focusing with the camera.

- Start in landscape orientation and hold the device eight inches (~20 cm) from the test image.  
**iPhone 6 or later:** The test image should quickly come into focus.  
**Other models:** Once steady, the yellow focus square should appear briefly and the test image should be in focus.
- Keep the device in landscape orientation and hold the device three feet (~1 m) from the test image.  
**iPhone 6 or later:** The test image should quickly and seamlessly come into focus.  
**Other models:** Once steady, the yellow focus square should appear shortly, with the test image eventually brought into focus.
- Rotate the device to portrait orientation and hold the device three feet (~1 m) from the test image.  
**iPhone 6 or later:** In a well-lit room, the test image should stay in focus as you rotate. If the room is not well lit, the yellow focus square may appear. The image should not jump around or be severely out of focus during rotation.  
**Other models:** Once steady, even though the test image is already in focus, the yellow focus square may still appear in the preview indicating that the camera is trying to refocus. This is normal. Once the focus is complete, the test image should still be in focus.
- Keep the device in portrait orientation and hold the device eight inches (~20 cm) from the test image.  
**iPhone 6 or later:** The test image should quickly come into focus.  
**Other models:** Once steady, the yellow focus square should appear shortly, with the test image eventually coming into focus.
- Verify that the primary colors are representative of the printed test image and that there are no dark spots near the edges of the photo.

h. Change the focus area and set the exposure: The yellow square on the screen shows the area where the camera is focusing the shot. Tap the screen to focus on the circle of the test image.

i. Set flash mode (camera or video mode): Tap the flash button, then tap On.

- If possible, take the photo in a dim or darkened area to show where the flash is lighting.
- Check that the flash is lighting the circle in the test image and that the flash is not shifted to one side.

j. Zoom in or out: Pinch the screen, then use the slider at the bottom of the screen to zoom in or out.

k. Touch the icon to select the FaceTime or TrueDepth camera. Repeat steps d–i above. This will test the



FaceTime or TrueDepth camera, front mic, and the Retina Flash. **Note:** The FaceTime or TrueDepth camera does not zoom, and only has a flash on iPhone 6s, 6s Plus, SE, 7, 7 Plus, 8, 8 Plus, X. The Retina Flash is only available in photo, portrait, and square modes. It may be easier to hold the printed test image in front of the iPhone to test the FaceTime camera.

#### **Additional Testing for iPhone 5c and later:**

Use the camera slow-motion mode to record short videos of the printed test image and verify video quality.

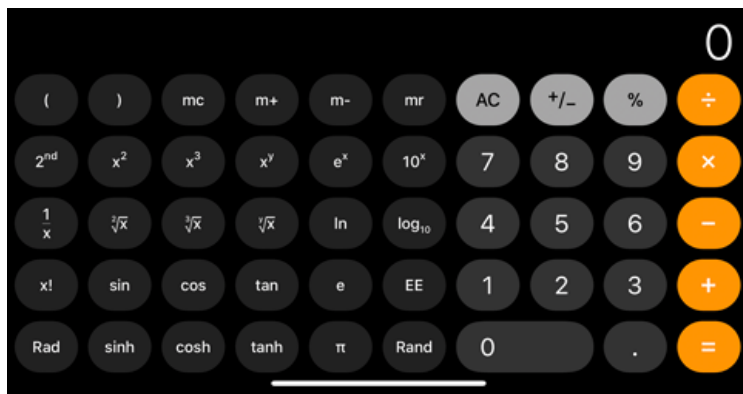
- a. Switch the camera to slow-motion mode and keep the device in either landscape or portrait orientation.
- b. Set to 1x zoom, hold the device eight inches (~20 cm) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.
- c. Stay in 1x zoom, hold the device three feet (~1 m) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.
- d. Tap 1x to switch to 2x zoom, hold the device three feet (~1 m) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.
- e. Stay in 2x zoom, hold the device 20 inches (~50 cm) from the test image, tap to focus, and record a short video. Pinch the screen to zoom in and out.

#### **6. Test Multi-Touch and Accelerometer**

- a. Run the following AST 2 diagnostic suites: use Multi-Touch to test for Multi-Touch response issues; use Unexpected Touch to test for overly sensitive touch response issues; use MRI to test for the presence of Multi-Touch and Accelerometer hardware.
- b. Launch the Calculator app to test all but the top section of the screen. Hold the device in a vertical plane (upright), not horizontal (flat). Tap each button on the calculator to verify activity.



- c. Rotate the device to the left to launch the scientific calculator. Tap each of the keys. Rotate the device 180 degrees to the right and tap each of the keys.



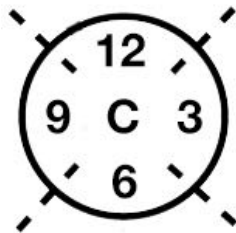
## 7. Test Buttons, Switches, and Vibe

Test buttons, switches, and vibe for expected functionality and tactility.

- a. Run each of the button and switch diagnostic suites in AST 2. Each suite tests the functionality of a specific button or switch.
- b. Test the Home button using the following steps, depending on model.

### iPhone 6s, 6s Plus, SE, and earlier

- Test clicks and double-clicks on the Home button.
- Press and hold the Home button for Voice Control or Siri.
- With the display off, press the center of the Home button and verify that the display turns on.
- Use the pointed end of a black stick to repeat the same test for the top, bottom, left, and right edges of the Home button (as shown by the numbers in the image below). The display should turn on when pressing any of these five locations.



- If no functional issues are found after testing the button with a black stick, use your finger or thumb to test for button stiffness, looseness, or mechanical symptoms.

### iPhone 7, 7 Plus, 8, 8 Plus

- Test single-clicks and double-clicks on the Home button.
- Press and hold the Home button for Voice Control or Siri.
- With the display off, press the center of the Home button and verify that the display turns on.
- When pressing the Home button, verify that the taptic feedback simulates a physical button press.
- If the Home button does not respond in the above steps, test Touch ID functionality in Section 10 of this article.

c. Use your finger to repeatedly press the volume up/down buttons and verify that the sound level indicator on the display is changing.

d. Use your finger to toggle the Ring/Silent switch back and forth and look for a bell icon on the screen.

e. Press the Ring/Silent switch and verify that the bell icon does not appear on the screen. **Note:** Do not toggle the switch.

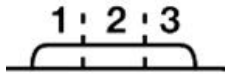
f. Test the vibrate function.

1. Go to Settings > Sounds > Ringtone > Vibration.
2. Choose S.O.S.
3. Verify that the phone vibrates in the correct pattern.

g. Locate the Sleep/Wake or Side button on the device, near the top right corner or right edge. **(All iPhone models)**

- Use the pointed end of a black stick to press the left side of the button (1 in image below) once, to put the device into sleep mode (the display will turn off).

- Use the pointed end of a black stick to press the center of the button (2 in image below) once, to wake the device.
- Use the pointed end of a black stick to press the right side of the button (3 in image below) once, to put the device into sleep mode (the display will turn off).
- Use your finger to press the button again to wake the device.
- Use your finger to press and hold down the button until “slide to power off” appears on the screen.



h. If no functional issues are found after testing buttons with a black stick, use your finger or thumb to test for button stiffness, looseness, or mechanical symptoms.

## 8. Test Ambient Light Sensor

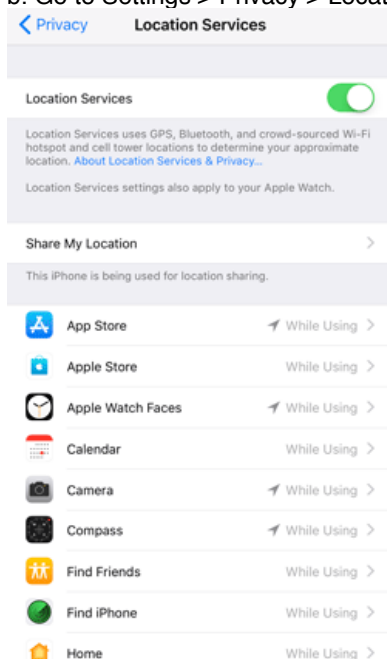
The ambient light sensor (ALS) automatically adjusts the display brightness to an appropriate level for the current ambient light conditions. The ALS brightens the display when using the device in a bright light environment, and dims the display in low light.

- Run the MRI diagnostic suite in AST 2, which tests for the presence of ALS hardware.
- Toggle Auto-Brightness off and then on in Settings > General > Accessibility > Display Accommodations.
- Press the Sleep/Wake or Side button to put the device into sleep mode.
- In a bright light environment, cover the top third of the front of the device to block the light (the base of your hand works well). The ALS is located near the receiver.
- Press the Sleep/Wake or Side button to wake the device. While the ALS is covered, the display should be dim.
- Uncover the top of the device. After a few seconds, the display should return to its normal brightness.

## 9. Test Location Services

Location services depend on data service availability. Data services are subject to change and may not be available in all areas. This may result in unavailable, inaccurate, or incomplete maps, directions, or location-based information. Maps uses Wi-Fi hotspots to determine the most accurate location. For more information, refer to article [HT203033: About privacy and Location Services in iOS 8 and later](#).

- Run the MRI diagnostic suite in AST 2, which tests for the presence of gyroscope and compass hardware.
- Go to Settings > Privacy > Location Services and turn on Location Services.

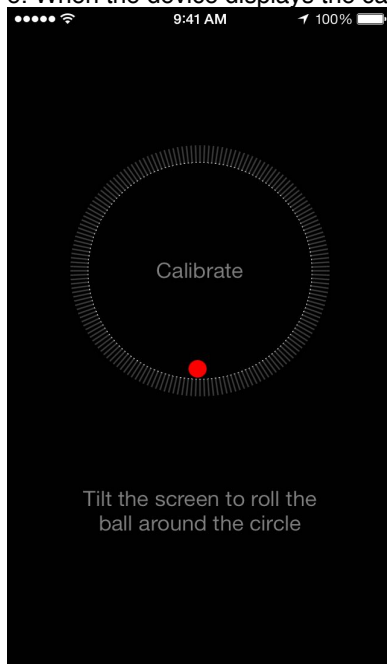


- Launch the Maps app and tap the arrow in the lower left corner of the screen. Maps should display the device's current location.



d. Open the Compass app.

e. When the device displays the calibration alert, tilt the screen to move the red ball around the circle.



f. Verify that when the iPhone is rotated, the heading shown on the screen changes according to the motion of the device.

## 10. Test Touch ID (iPhone 5s, SE, 6, 6 Plus, 6s, 6s Plus, 7, 7 Plus, 8, 8 Plus)

This test should be performed with the user to verify Touch ID functionality. Ensure that the Home button and your finger are clean and dry.

- Run the MRI diagnostic suite in AST 2, which tests for the presence of Touch ID hardware.
- Go to Settings > Touch ID & Passcode and tap "Add a Fingerprint..."
- Hold the device as you normally would when touching the Home button.
- Touch your finger to the Home button and hold it there until you feel a quick vibration or you are asked to lift your finger. **Tip:** Do not press the button, just touch lightly.
- Continue to touch and lift your finger slowly, making small adjustments to the position of your finger each time.
- Once the initial scanning is complete, you will be asked to adjust your grip in order to capture the edges of your



fingerprint.

g. Hold the device as you normally would when unlocking it, touching the adjacent outer areas of your fingertip instead of the center portion you initially scanned.

h. Press the Sleep/Wake or Side button to lock the screen.

i. Press the Home button or Sleep/Wake or Side button once to wake the device and keep your finger lightly on the Home button. The device will unlock when the fingerprint is recognized.

## 11. Test 3D Touch and Taptic Engine (iPhone 6s and later)

This test should be performed with the user to verify 3D Touch and Taptic Engine functionality.

**Note:** The iPhone must pass the Multi-Touch test above or the AST 2 diagnostic suites: Multi-Touch, Unexpected Touch, and MRI.

a. Go to Settings > General > Accessibility > 3D Touch and confirm that the 3D Touch setting is enabled and sensitivity is set to Medium. 3D Touch must be enabled for 3D Touch and Taptic Engine functionality.

b. Go to Settings > General > Accessibility > Vibration to enable the Taptic Engine.

c. Use the 3D Touch Sensitivity Test to check the Peek and Pop functions. Look for the visual feedback and feel for the haptic feedback.



Peek



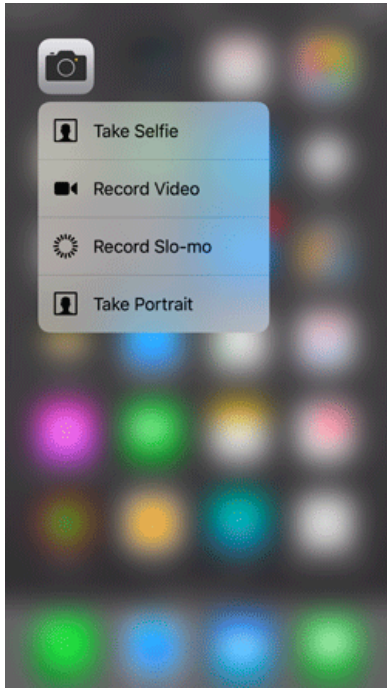
Pop



d. Press the Home button to return to the Home screen.

e. Hold the iPhone with the display perpendicular to the floor.

f. Firmly press on one icon in the center of the display to test 3D Touch. Look for visual feedback. If the app does not support 3D Touch, then the area around the app icon will blur momentarily and provide haptic feedback then return to the home screen. If the app supports 3D Touch, then a contextual menu will appear with a background blur.



g. Feel for haptic feedback when pressing the app icons.

h. Hold the iPhone with the display parallel to the floor and repeat steps f and g.

## 12. Test True Tone display (iPhone 8, 8 Plus, and X)

This test should be performed with the user to verify the True Tone display.

a. Toggle True Tone off and then on in Settings > Display & Brightness

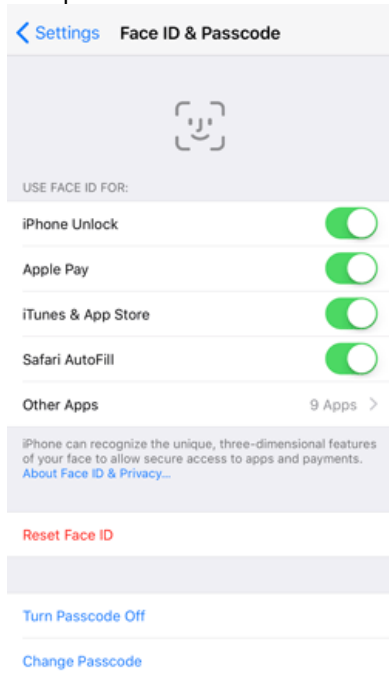
b. Make sure that the tint of the white displayed changes when True Tone is toggled on and off.

## 13. Test Face ID (iPhone X)

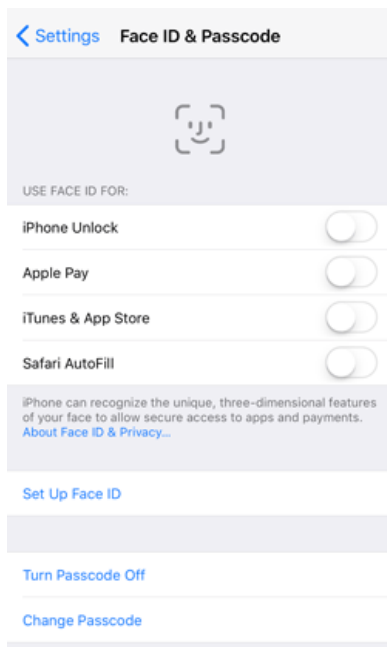
This test should be performed with the user to verify Face ID.

a. Go to Settings > Face ID & Passcode

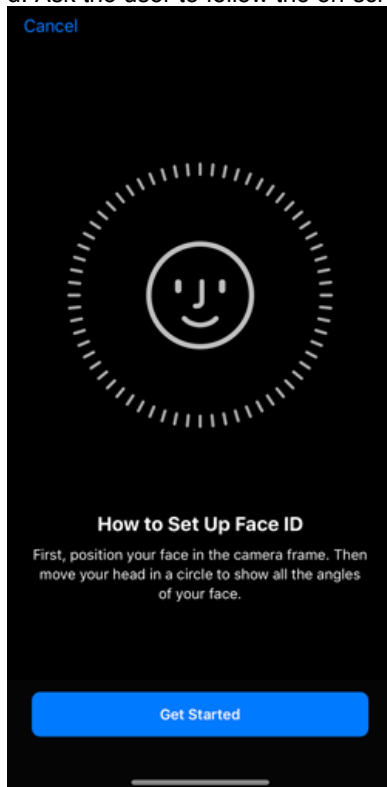
b. Tap Reset Face ID if Face ID has been enabled.



c. Tap Set Up Face ID.



d. Ask the user to follow the on-screen instructions.



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